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GLOBAL CLIMATE CHANGE PREVENTION ACT OF 1989—S. 1610

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HEARING

BEFORE THE

COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

ON

S. 1610

TO DEVELOP A PROGRAM TO DETERMINE POTENTIAL IMPACTS OF CLIMATE CHANGE ON AGRICULTURE AND FORESTRY, TO PROVIDE FOR THE DEVELOPMENT OF POLICIES DESIGNED TO ADDRESS ISSUES OF POTENTIAL CLIMATE CHANGE, WITH RESPECT BOTH TO DEVELOPING A CAPACITY FOR AGRICULTURE AND FORESTRY TO ADAPT TO CLIMATE CHANGE, AND TO DEVELOPING INNOVATIVE WAYS TO AMELIORATE CLIMATE CHANGE, AND FOR OTHER PURPOSES

NOVEMBER 6, 1989

Printed for the use of the
Committee on Agriculture, Nutrition, and Forestry

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GLOBAL CLIMATE CHANGE PREVENTION ACT OF 1989—S. 1610

MONDAY, NOVEMBER 6, 1989

U.S. SENATE,
COMMITTEE ON AGRICULTURE, NUTRITION, AND FORESTRY,
Washington, DC.

The committee met, pursuant to notice, at 2:08 p.m., in room SR-332, Russell Senate Office Building, Hon. Patrick J. Leahy (chairman of the committee) presiding.

Present or submitting a statement: Senators Leahy, Conrad, Lugar, Cochran, Boschwitz, Bond, and Gorton.

STATEMENT OF HON. PATRICK J. LEAHY, A U.S. SENATOR FROM VERMONT

The CHAIRMAN. Legend has it that in ancient Rome, Nero played his fiddle while Rome burned.

Today it is the rain forests of the Amazon that are ablaze, and the entire planet is threatened with global warming.

We can look at satellite photos, as I have, of the rain forests in the Amazon and actually see the fires and see hundreds of miles of trails of smoke from them. I think global warming is one of those issues that affects us on both a local and international level.

On a local level, scientists tell me that the increased concentration of carbon dioxide in the air may mean the end of maple trees in Vermont. Some predict this happening within the next 30 to 80 years.

On an international basis, some scientists foresee a dramatic 50 percent reduction in rice production due to a mere 4-degree rise in average temperature. Because rice is the basic food for 70 percent of the world's population, global warming could devastate the world's food supply and reverse the green revolution.

I have introduced a package of three bills to address global warming.

First is the Global Environmental Protection Act of 1989 (S. 333), which sets a tough phaseout schedule of CFC's and other greenhouse gases, such as nitrogen oxides, tailpipe hydrocarbons, and methane. Those proposals are being actively considered in the Energy and Public Works Committee.

Second is the International Climate Change Prevention Act of 1989 (S. 1611), which focuses the U.S. foreign aid program on the critical problems of tropical deforestation and wasteful use of energy. All of the key provisions and resources in this bill are included in the foreign operations appropriations bill which passed the Senate and is in the House-Senate conference report which should be passed later this week.

Third is the Global Climate Change Prevention Act of 1989 (S. 1610)—the bill we are holding hearings on today.

Mr. Secretary, if we can have help from you and the administration, we could complete action on the bill quickly and put in place two-thirds of the global warming program.

S. 1610 has two primary goals:

One, agriculture must help prevent global warming.

Increased CO_2 from automobiles and factories is a major cause of global warming. Trees and plants can absorb greenhouse gases, but the projected dramatic increase threatens to overwhelm the natural balance.

This legislation provides for massive reforestation of at least 3 million acres (CRP acres) of trees—enough to fill the entire State of Connecticut. These new trees will absorb 8 million tons of carbon annually. Also (this is something you and I have discussed before) the legislation talks about the planting of trees in urban areas.

Two, agriculture must not be a victim of global warming.

We heard about the sensitivity of agriculture and forestry to climate changes in earlier hearings.

The potential for destruction of U.S. agriculture by climate change is enormous. So is the potential for the disruption of world food security. Some scientists warn that dramatic warming would probably decrease average yields of wheat, corn, and soybeans.

We learned in our hearings that forests could take an even greater hit from climate change. Forests would be more susceptible to insects, disease, and fire.

I talked about my own State of Vermont. This bill is far from parochial. Major temperature changes in the Southeastern United States, for example, could turn substantial woodlands into grasslands.

The legislation seeks ways to ensure that agriculture survives in a warmer world and continues to provide the quality and quantity of food that we and the rest of the world need.

We're not going to settle all the problems of global warming, but I get a little bit frustrated when we hear talk about global warming. Everybody says "it's such a huge problem, there's nothing we can do about it." There are so many different aspects of it. Well, we have attacked a whole number of aspects in these three pieces of legislation. Others will be going after other parts of it in their own legislation.

This is not a partisan issue. This is something that unites all of us. It's really not even a political issue. If we're concerned as citizens of this country and citizens of the world, we have to do something.

It requires USDA to take an active role in reducing the effects of global warming on our food supply and forests.

Today, we are fortunate to have Secretary Yeutter here to talk about the problem of global warming and USDA's plans to address it.

So I am delighted you are here, and I would like to yield to Senator Lugar.

STATEMENT OF HON. RICHARD G. LUGAR, A U.S. SENATOR FROM INDIANA

Senator **LUGAR**. Thank you, Mr. Chairman.

As I have done on other occasions—and I will do so today—I applaud your personal efforts and witness in this general subject matter of global warming and so many other environmental matters. I applaud specifically the bill S. 1610, and it is my privilege to cosponsor that legislation. I'm grateful the Secretary is here today, which is indicative of the interest of the administration in this legislative effort.

In the State of Indiana, we have attempted over the years to try to interest people in planting trees on small plots. We have the hardwoods industry, a good furniture industry of the past. Beyond that, the conservation ethic implied in this legislation is important. But the goals of S. 1610 certainly boost that and go well beyond it. It's a situation in which I hope all people who are in agriculture throughout the country will become involved so that the aggregate of these millions of acres contemplated in the bill will be comprised of the efforts of millions of individual persons—farm families, people in small towns of America.

I would say, as we pointed out at the beginning of the initiation of S. 1610, Mr. Chairman, there is debate as to the threat of global warming or how rapidly cataclysmic events might come to pass. But it seems to me a prudent person takes every precaution to prevent potential disasters, to try to get some handle on the size, shape, and timing of these events, and clearly what the implications will be for the food supply of the planet.

For all these reasons, I applaud this legislative effort and look forward to the testimony at the hearing today, and hopefully swift passage by this committee and the Senate.

The **CHAIRMAN**. Thank you.

Does anybody else have anything to say?

Senator **GORTON**. I'll give you one for the record. How about that?

The **CHAIRMAN**. Thank you. Thank you very much.

[The prepared statement and questions of Senator Gorton and responses from the Forest Service follow:]

PREPARED OPENING STATEMENT OF HON. SLADE GORTON, A U.S. SENATOR FROM WASHINGTON

HEARING ON S. 1610, THE GLOBAL CLIMATE CHANGE PREVENTION ACT OF 1989

Mr. Chairman, I am pleased to be provided with this opportunity to consider testimony on S. 1610, impressive legislation introduced by yourself and others, which aims to prevent the serious effects of global climate change.

Throughout my Senate career, I have advocated expansion of research efforts for our Earth, oceans and atmosphere. In the past I have supported measures to establish a global foresight capability with respect to natural resources, the environment and population. I plan to continue to be actively involved in these efforts.

As you know, Mr. Chairman, there is a growing concern and increasing evidence that mankind is dangerously altering the Earth's atmosphere through the introduction of huge quantities of "greenhouse" gases. The continued alteration of our atmosphere may fundamentally change the conditions governing life on Earth by altering the basic climatic conditions under which we live.

In my view, the United States must take a strong leadership role by aggressively bringing the greenhouse effect issue to the attention of the global community, leading the world community in emissions reductions and developing safe, economic and reliable technologies. The greenhouse effect problem is not just a U.S. problem. It is a global problem and must be addressed by the entire global community.

Appropriate action could delay the deepening of greenhouse effect by half a century or more. Such a delay could be crucial, and could spell the difference between disastrously rapid climate change and a manageable transition.

The legislation which will be commented upon addresses the need for appropriate action and I look forward to hearing the testimony to be presented to us today.

[Responses to questions submitted by Senator Gorton to the Forest Service follow:]

QUESTIONS FROM SENATOR GORTON AND RESPONSES FROM THE FOREST SERVICE

Question 1. To what extent does the Forest Service already have the authority to consider the effects of climate change within the forest management planning process?

Answer. The Forest Service has the authority to consider the effects of climate change within the NFMA planning process. However, the effects of any changes cannot realistically be evaluated because there is a substantial gap between what the scientific community predicts for climate change and the availability of research-based information on the potential effects on forest ecosystems of those predicted climate changes.

The Forest Service has initiated a 10-year research program to determine the effects of possible climate change and air pollution on the national forests and ranges. Once this research provides results, meaningful predictions of ecosystem responses can be made.

Question 2. Have they indicated a need for this language, or problems with this language?

Answer. The Forest Service has not indicated the need for an amendment of the NFMA to include consideration of global warming effects in the planning process.

This is an emerging issue of potentially great significance; however, due to the lack of scientific information, consideration of climate change in planning documents would amount to no more than a simple recognition of the potential problem coupled with pure conjecture as to possible effects. We do not believe it is timely to require such an analysis at the forest plan level.

Question 3. With such language, to what degree would the Forest Service have to modify final forest management plans?

Answer. The implications of this language are potentially tremendous. It would lead to forest by forest analysis with little results other than to recognize the issue. Any factual analysis is not possible, and conclusions would have to be pure conjecture. Thus, it would not lead to better land management decisions at this time.

Should any potential effects on forests become likely, we believe that only national level programmatic documents can provide the vehicle to address this subject.

In any case, added research and results are mandatory before the language required in S. 1610 Sec. 215(c) could be meaningfully carried out.

The **CHAIRMAN**. Senator Conrad.

Senator **CONRAD**. How about if I don't take time now and don't give you one for the record?

The **CHAIRMAN**. We'll accept that. You owe me for that, but we'll accept it. [Laughter.]

Mr. Secretary, quick before he recovers.

STATEMENT OF CLAYTON YEUTTER, SECRETARY OF AGRICULTURE, U.S. DEPARTMENT OF AGRICULTURE, ACCOMPANIED BY CHARLES E. HESS, ASSISTANT SECRETARY FOR SCIENCE AND EDUCATION; ELDON W. ROSS, ASSOCIATE DEPUTY CHIEF FOR RESEARCH, FOREST SERVICE; AND GARY R. EVANS, SPECIAL ASSISTANT FOR GLOBAL CHANGE ISSUES

Secretary **YEUTTER**. Mr. Chairman, I cannot duplicate Senator Conrad's generosity.

The **CHAIRMAN**. We don't want you to.

Secretary **YEUTTER**. I have a prepared text available, Mr. Chairman, but I'd like to, if I may, embellish upon that a bit in my oral testimony.

COMMENDATIONS

First of all, commendations to you, Senator Lugar, and others for your personal interest in this subject which, as you indicated, Mr. Chairman, is one that should be of interest to all human beings on this planet.

THE CHALLENGE

The problem or the challenge, as all of us see it, relates to rising carbon dioxide levels—the so-called "greenhouse effect" that is often referred to in articles these days.

OPINION AND STATISTICS

There is some difference of opinion among scientists as to the magnitudes of what is happening or perhaps even the direction of what is happening, but, nevertheless, one can readily cite a few relevant statistics that ought to lay the groundwork for all of our efforts in this area. One is that measurements of CO_2 levels in Greenland and the Antarctic indicate very substantial increases since 1950. There are increases in methane levels, decreases in the stratospheric ozone layer. We've had the 4 warmest years of the past 150 in the 1980's. The cosmonauts and astronauts have both observed a thinning of the atmosphere; at least they believe there's a thinning of the atmosphere. We do know that man is causing a great deal of carbon dioxide pollution, if one can use that term, because of the enormous amounts that we put into the air each year. The total is several billion tons annually. It amounts to something like 1 ton per person for the entire globe, and that's a lot of carbon that has to be absorbed in some manner.

As I indicated, there's not a uniform view among scientists as to whether what we are experiencing is global warming. In fact, Mr. Chairman, I just talked to a prominent scientist a couple of nights ago, and he believes that there is a more persuasive case to be made for global cooling than there is for global warming. But that's just a reflection of the difference of opinion that is not at all unusual in this situation.

THE CONCLUSION I DRAW FROM THIS DEBATE

The conclusion I draw from this debate, Mr. Chairman, and one that apparently you and other members of your committee have drawn is that it is probably worthwhile for all of us to be prudent, irrespective of what the trend may be. We do know that there is a trend toward global change, and we should take whatever actions are necessary to permit us to adjust and adapt to whatever that change may be, whether it turns out to be warming, cooling, volatility between and among the two or other aspects that may come along.

As someone recently put it, the problems that take a long time to build up often take a long time to fix. I suspect this is a problem that has taken a long time to build up, or at least one can so hypothesize. Therefore, perhaps we ought to take some prudent actions that would reduce or minimize the time that would be required to fix whatever might need be fixed.

WHAT KIND OF ACTIONS CAN WE TAKE?

What kind of actions can we take? Well, certainly, one relates to research. There's a lot going on already in the way of research, as I'm sure you all know. I brought with me today a publication that I'll just show you, Mr. Chairman, and other members of the committee. This is called "Our Changing Planet: The fiscal year 1990 Research Plan," the U.S. Global Change Research Program, to be specific, which is being monitored and supervised by the Committee on Earth Sciences, which is an interagency committee within the U.S. Government chaired by Dr. Alan Bromley, who is the White House science adviser. USDA is a part of this effort. It's a very impressive program already. Certainly, we need to develop this program, build on it in the future.

There is just a lot that we can do in the way of research to learn how to be more adaptable and flexible to whatever may come along in the future in this area.

WITH RESPECT TO YOUR LEGISLATION

Now, with respect to your legislation, Mr. Chairman, I'd like to comment somewhat more specifically now than I have in my written testimony, and then we'll go to questions. One element of your bill would suggest the creation of an Office of Climate Change within the Department, the idea being to coordinate whatever efforts we may undertake in the Department of Agriculture to respond to this challenge, whatever it may be. The coordinative objective is a proper one, and we certainly subscribe to that.

I'd like to return at a later date, perhaps within the next few days, Mr. Chairman, and make some recommendations for specific changes in the language in order to permit us to fit this program most appropriately within the administrative structure of the Department. For example, the present legislation calls for this office being run by a director who would report directly to me. We already have too many people reporting directly to the Secretary of Agriculture, so I'd like to change that. I'd really like to fit it within the structure that we've recently established for dealing with these kinds of what we call cross-cutting issues. There are a lot of issues today that cut across various agencies of the Department. We've begun to coordinate those now through what we call a Policy Coordinating Council, which is chaired by Deputy Secretary Parnell. Ground water quality falls into that category; food safety, as we discussed a few days ago; and there are a number of others.

It seems to me that we ought to fit this kind of program, which does require interagency coordination, within our Policy Coordinating Council framework, and we'd like to suggest some language to do that.

Your legislation recommends or authorizes some studies on global climate change in a general way and then some specific udies that go beyond the general activity. Those are fundamentally sound projects. We would like to suggest, however, that they might be broadened somewhat in that the present references to climate change are probably a little too narrow. We need to be cognizant and sensitive to the direct effects of CO_2 concentration on plant growth and performance, not just the changes in climate itself but the effect of that on the performance of plants and crops.

Our folks would also add the need to encompass in any research program in this area also the question of elevated ultraviolet radiation levels and the effect that those would have on plant growth and performance. So those are two major areas that conceivably could be excluded from the study program as it's now drafted, although it may well be that you had no intent to do that. We just feel a broadening in that area might be appropriate.

The legislation lays down some specific timetables in these areas. We have some reservations about some of those timetables. They're fairly tight, and I'm not sure that we can get the kind of research results in that kind of a time frame that you would like to see or we would like to see. One could do so by spending a lot more money, perhaps, but all of what we do here has to be subject to budgetary constraints. It seems to me as we work through this, Mr. Chairman, we need to consider the tradeoffs between budgetary requirements and demands and the scientific output that might result. So we'd like to have some further conversation on that subject at a particular point in time.

WITH RESPECT TO FORESTRY

With respect to forestry, I'm very pleased, of course, that your legislation demonstrates an interest in doing some things in the forestry area. We began work on that, as you know, and hope to have some things to say from the standpoint of the administration as a whole relatively soon. Our program will go substantially—conceivably could go substantially beyond what's being contemplated in this legislation, but I see nothing in the way of thrust here that would contradict what we're evaluating and analyzing and what is already under way.

I liked the thrust into urban forestry. We even have my wife, Jeanne, Mr. Chairman, working in that area now. She just launched about a month ago a program that she calls "Tree-mendous America," spelling it t-r-e-e, which is intended to promote tree plantings in urban areas around the country.

The **CHAIRMAN**. I was thinking of Mrs. Yeutter when I mentioned that earlier because she was describing to a number of people in Vermont her interest. Of course, you were volunteering her even at that point.

Secretary **YEUTTER**. Her services, that's right, Mr. Chairman. Well, she's very enthusiastic about it, and I hope we can make progress in that area.

Internationally—and, by the way, the Forest Service already has a very substantial program in their urban planting area. This is the publication entitled "Forestry: A Community Tradition," which I would also commend for the committee's deliberations.

INTERNATIONAL SIDE

Then on the international side, I was pleased that you provided some input on that as well. The Forest Service likewise has begun to work more aggressively internationally. Here's one of the publications, "Global Neighbors Growing Together: A Tropical Forestry Program." And here's another one from the FAO, Food and Agricultural Organization—as you know, I'll be going to their meeting in Rome next week, and this may well be on the agenda for part of that meeting. It's the Tropical Forestry Action Plan of FAO which is important as we deal with developing countries, of course.

WE WOULD LIKE TO SUGGEST A COUPLE OF CHANGES ON WHATEVER MIGHT BE DONE IN THIS BILL ON THE INTERNATIONAL SIDE

We would like to suggest a couple of changes on whatever might be done in this bill on the international side. One relates to some provisions that would seem to require the approval of AID before these programs could be undertaken. We believe that's too narrow. We have an excellent working relationship with AID, and, as you may know, a good personal friend of mine and fellow Nebraskan is about to be named as Administrator of AID. But notwithstanding that, we believe that some of the programs that you have outlined in your legislation and that we as an entity might wish to do go beyond just the developing countries. Therefore, that would make the AID approval or sanction inapplicable or irrelevant. In other words, we ought to have the authority to deal with countries where AID is not active. And even in countries where AID does function, it may well be desirable sometimes for us to provide technical assistance or have other kind of joint or cooperative relationships with agencies with whom AID is not working. It seems to me that even in the developing countries those provisions are too narrow and probably should be changed.

Brazil, for example, is a country in which tropical forestry is a major issue, and yet at the moment AID does not have programs in Brazil. So we would need to change that.

We also suggest, as we have in similar legislation on the House side, the idea of using what we call cost-share partnerships rather than competitive grants on the urban forestry program. I neglected to mention that. The Forest Service likes to use partnerships with local communities, and we'd like to see that built in, perhaps as an alternative to the competitive grant language that's used in the legislation here.

ON THE PROGRAM SIDE

Then, finally, on the program side, there are provisions here that relate to doing a demonstration on biomass energy, or demonstrations of biomass energy projects. That is certainly appropriate. We're going to have to move away from such heavy dependence on fossil fuels and into the biomass fuels area. Agriculture has a major stake in that area. My judgment from just cursorily looking at your legislative language is that it might be a bit too narrow in this area as well. It has primarily a forestry orientation. I suspect we might want to go somewhat broader than forestry in looking at biomass energy demonstrations.

OTHER ELEMENTS THAT WE MIGHT SUGGEST BEING EITHER ADDED OR CHANGED

There are a couple of other elements that we might suggest being either added or changed, one relating to the provision of an agricultural weather information system. Another might well relate to the idea of adding some sociological research as a part of the authorization here. And there are a few other minor things as well that we'd like to suggest.

WE FUNDAMENTALLY SHARE WITH YOU THE THRUST THAT'S ENCOMPASSED AND ENVELOPED IN THIS BILL

Mr. Chairman, I would just close by saying that we fundamentally share with you the thrust that's encompassed and enveloped in this bill, and we would look forward to working with you on polishing it up a bit, if we can call it that, in line with some of our own views that are, in essence, very comparable to yours.

The CHAIRMAN. Well, thank you, Mr. Secretary. I appreciate your support of the basic thrust of it. I would urge you to have those within your administration who can speak for you on this issue work with Senator Lugar's staff and with my staff and let us look at these areas. I think you, Senator Lugar, and I want to get the same end result. Let's see how close we can work together to get that.

I'm wondering when global warming issues are raised within the administration, whether it's by a task force—are you consulted? Is your Department consulted, especially on issues where climate change might be an integral part of the process?

Secretary YEUTTER. I am sure we are, but if I may, Mr. Chairman, I'd like to invite Assistant Secretary for Science and Education, Dr. Charles Hess, to come up and join us. He is more involved, perhaps, than any of us. If I may, I'll just refer that question to Dr. Hess.

Dr. HESS. Mr. Chairman, we have been participating on the Committee on Earth Sciences which has developed the program that the Secretary showed you in the bulletin, and there has been excellent consultation with our colleague agencies in developing that.

The CHAIRMAN. There has been a great deal of discussion whether the United States should be represented at the Hague meeting of environmental ministers. I realize once the administration's position is made, naturally all of you are to be supportive of that. But were you involved in that discussion or any of the debate?

Dr. HESS. No, Mr. Chairman, I was not here when that debate took place.

Secretary YEUTTER. I was not involved, Mr. Chairman. To my knowledge, that was a discussion between our environmental minister, Mr. Reilly, and the White House.

The CHAIRMAN. I would strongly suggest—and I can't tell the administration what they should or should not do, but if you're going to be involved in these issues, that you should be consulted and for this reason: There are a lot of issues involved in the question of global warming—or global cooling, either way, no matter which—accept that it is going to affect American agriculture. You've heard me say many a time that we're the only major power in the world able to feed ourselves, provide all the food we need for our people, and still have food left over. But if we have major climate changes, that could change dramatically. It's obviously a national security issue. How are we going to continue to be able to feed ourselves? How are we going to be able to continue agriculture? But it becomes also a social and economic issue. What do you do with thousands, tens of thousands of farms around our country if suddenly climate changes change everything that they're able to grow or the way they grow it? If our forests suddenly change, then you're talking about decades worth of decisions that have to be made. It's not like changing a crop from year to year.

If you're going to be the advocate for farming in this country, as you should be, then I would strongly urge that the administration consult you on these climate-change issues, because it will have a major effect on the things within your jurisdiction, not the least of which is that—I've said it over and over again—a basic tenet of our national security and national economy, the ability to feed ourselves, and not have to import.

Secretary YEUTTER. I would just add, Mr. Chairman, that much of the discussion on this and other similar topics is now taking place within what we call the Domestic Policy Council, and, in fact, some of our potential international activity in the environment and in global warming has had significant debate in that forum. This is one that's chaired by the President with Attorney General Thornburgh as the chairman pro tem. But all the relevant Cabinet officers, including myself, sit on those. So we have ample opportunity in that forum, but the specific meeting that you've talked about was handled in a somewhat different way.

The CHAIRMAN. In your prepared statement you talk about petroleum-intensive agriculture and the effect that may have on the whole issue. Do you want to expand on that just a bit?

Secretary YEUTTER. Well, certainly, we now have not only agriculture but an economy as a whole that is very heavily petroleum dependent. We're more petroleum dependent than any nation in the world and, as you know, not only petroleum dependent but petroleum import dependent. So we must evaluate these kinds of issues not only in terms of whether fossil fuels are the way to go for the future, whether we can afford that, but also whether we can afford to be so heavily dependent on a fuel source that can only partially be found here in the United States or where our needs can only partially be met here in the United States, and where a very substantial portion must be met from abroad. That has balance of trade, balance of payments implications as well as competitive implications and national security implications.

Our view is that whether in the agriculture or the industrial sector, Mr. Chairman, if we can reduce our level of dependence on petroleum—that is, fossil fuels in general, but petroleum in particular—and if we can reduce our dependence on imported petroleum, we can all rest more comfortably.

Senator LUGAR. Mr. Chairman, I would like to ask the Secretary a question.

You mentioned a controversy about the degree of global warming, specifically about the intriguing statements that we were instead in a period of global cooling. I just can't let that pass without asking who the source of that alternative viewpoint is, and where those who want to read more about that point of view might find more information.

Secretary **Yeutter**. I would not want to in any way embarrass the individual who made that comment to me in a social conversation. But if the individual is willing to indicate to the committee or to you the source of his views, I would be happy to query him on that point for you.

Senator **Lugar**. Well, I would appreciate that. It's such an unusual point of view. It may very well be correct, but clearly, as we are all plunging ahead on the global warming idea, if there is another point of view, why, it probably needs to surface.

Secretary **Yeutter**. Sure.

Senator **Lugar**. What is the Department now doing or what would you intend to do, given this legislation or just your general inclination, to give people in this country or people in American agriculture in particular some benchmarks as to the seriousness or the progress of the global warming situation? I ask this not because I believe that it's the total obligation of USDA to do this; indeed, there may be another branch of the administration in which that responsibility is more appropriate. But clearly, one of the problems with this issue is that the number of persons furnishing surveys, and there are extensive longitudinal studies, as well as anecdotal material, have made this whole issue a very confusing one for most people in the general public, not to mention people in Congress, to deal with.

It may be that there aren't benchmarks, or that you can't make reports year by year. But I'm just asking out of curiosity if this is the case. In most other areas, we like to get some idea of progress or deterioration on which sound public policy can be measured, and the urgency of making those allocations as opposed to attacking other problems, particularly if large dollar outlays are involved. So what indicators lie ahead of us, or which ones do you have now?

Secretary **Yeutter**. I'd like to give a general response, if I may, Senator Lugar, and then I'd like to ask Assistant Secretary Hess to embellish upon it. We've had some discussion of this in the context of the clean air legislation because it seemed to me appropriate, Senator Lugar, that we measure progress in the whole area of clean air as well as what we might do in the global warming area.

I'm not a physical scientist, but it does seem to me that one of the things we clearly can measure here quite accurately is the CO_2 emissions. And it would seem that one of the challenges we ought to give to ourselves and to other nations around the world is one of quantifying the reduction of CO_2 emissions. We should establish some definitive goals in that area because we are all putting far too much CO_2 in the air today. It's a global problem. Certainly, we cannot solve it entirely ourselves because there are a lot of other nations who are generating difficulties in this area, too. But we do a lot of it through automobile emissions and other sources. So it would seem to me that the one particular area where we could measure, can and should measure progress should be in CO_2 emissions. But let me ask Secretary Hess to add his own comments.

Dr. **Hess**. Thank you, Mr. Secretary.

I certainly agree with the CO_2; others could be methane emission, the chlorofluorocarbon issue, all are measurable things. We could also look at how successful adapted research has been so far; that is, in developing plants which are more tolerant to high temperatures, low temperatures, or drought conditions. And I think we should continue that work. I think we should try to address the problem specifically, but at the same time, given the fact that it may be a long-range effect which you're not going to change readily, we should do adapted research as well.

The other one is that as we look at alternatives to have cleaner air and reduce CO_2, one of the suggestions is to look at alternative fuels. An alternative fuel that has been suggested has been methanol, but that doesn't necessarily solve the problem because you're still depending upon natural gas as the primary source, and so you're adding more CO_2 to the environment. If we could make ethanol, the cleaner alternative fuel, economically feasible and energy feasible, I think that has real possibilities in terms of our own strategic position, not being so dependent upon external sources for our energy. It could also have very important effects on lowering air pollution as well as then recycling CO_2 rather than adding new CO_2 to the environment. So, then, one measure could be is how much fuel are we using from ethanol or alternative fuel sources as compared to fossil fuels. So those would be some benchmarks I think we could use.

Secretary YEUTTER. And by ethanol, I presume, Dr. Hess, you would include ethanol-based derivatives like ETBE.

Dr. HESS. Absolutely; yes, which show an even greater practical possibility.

Senator LUGAR. I was just going to ask about ethanol, not only from a parochial standpoint but also from an environmental standpoint.

The CHAIRMAN. I don't think parochialism has ever come into this committee. [Laughter.]

Secretary YEUTTER. If I may, I'd like to respond to that, Senator Lugar, because I really believe that all of us have underestimated the potential for change in that area. As you know, ethanol has had difficulty competing in economic terms until now. But that's not to suggest that such will still be the case 5 or 10 years from now, nor is it to suggest that the same conditions would apply to ETBE. Here's an area in which there could readily be some research breakthroughs that would bring these fuels to the fore by the time they are expected to be needed toward the end of this century and beyond. And it does seem to me that it behooves us as a nation to engage in the research that is necessary to make a definitive determination in this area. In other words, we need to find out whether ethanol and ethanol-based fuels can be competitive in the U.S. marketplace and elsewhere. Because if we can succeed in this area, we can significantly reduce our dependence on foreign fuel sources.

Senator LUGAR. Well, indeed, we could. You're right that the problem of gasohol or ethanol or what have you has been the question of economics. Now, some of us have tried to keep alive this argument simply because we perceive that down the trail lies not only a national security issue but also environmentally where, by the way, problems already exist.

I don't know what the economic tradeoffs are. But we're here talking today about global warming, and presumably if it's a serious problem, it has all sorts of dollar signs attached to it. What I would hope is that USDA will begin to try to get all of these arguments on to the same table so that we don't discuss ethanol one year and global warming another and fail to see interrelationship.

I just have one final question. In the legislation we're discussing today, S. 1610, there is the specific thought of planting millions of acres of trees. This may get to the CO_2 concern or to other concerns that you have. Have you made any evaluation or can you make an evaluation as to whether the tree planting is a practical suggestion? In other words, sometimes in our enthusiasm we may decide to plant trees in every direction, and that may soak up the problem. However, it may not. But I'm just simply curious as to whether you see tree planting as a positive step in the global warming issue, notwithstanding the conservation arguments that you've posed?

Secretary **Yeutter**. We do see a positive mesh there and have had considerable internal discussion on that. With respect to precisely what we should do in the tree-planting area, we have not yet worked that through internally and will have some specific recommendations on that at a later time. So I'd like to defer that for the moment, both in terms of magnitudes of what would seem to be practical and appropriate in tree-planting and, secondly, obviously, in terms of the cost because tree-planting will not come free. But as to the scientific benefits, again, I will ask Secretary Hess if he would like to embellish.

Dr. **Hess**. Trees, of course, have the advantage of really sequestering the CO_2 and——

Senator **Conrad**. Don't use that word, please. [Laughter.]

Senator **Bond**. It may be the best available option. [Laughter.]

The **Chairman**. It does raise interesting possibilities.

Dr. **Hess**. It really ties it up.

Of course, the idea of using trees in urban locations has the additional advantages of providing shade that would reduce energy consumption for cooling as well as evapotranspiration, the cooling effect from the trees. So we are looking at the ability of various crops to fix carbon dioxide, and then calculating what the impact of the various strategies would be, whether it would be for reforestation or for growing crops specifically as source of biomass for energy.

Senator **Lugar**. Thank you very much, Mr. Chairman.

The **Chairman**. Thank you. We'll go to Senator Gorton, Senator Conrad, Senator Cochran, and Senator Bond.

Senator **Gorton**. Mr. Secretary, it seems to me that both the organization of the bill and the discussion have identified at least two, and perhaps three, different directions in which the bill points that are certainly not inconsistent with one another. One—and you've spent quite a bit of time on that—is how do we facilitate the learning process, which direction are we going, what kind of actions would be most appropriate in dealing with any of the threats.

The second clearly is causing the Department to consider global warming or climate change problems in connection with the substantive decisions which the Department makes, either in the field of agriculture, the promotion of crops and the like, or in the field of forestry.

The third element which may or may not be in this bill would be substantive requirements arising out of the bill itself.

How do you evaluate each of those three? And most particularly in connection with the second one, if you are required at either Agriculture or Forestry to consider new materials in connection with the decisions that you make, are you at all concerned about the possibility of one more layer of litigation frustrating the kind of decisions which the Department is going to make? In your preliminary analysis of this bill, could you maybe comment on the relationship between those two or three courses?

Secretary YEUTTER. Certainly. With respect to the final point you've just made, Senator Gorton, I doubt that there is much in this legislation that is likely to provoke additional litigation. But I'd like to make sure that our lawyers scan it appropriately to see.

Much of what is encompassed in the legislation is already under way to some degree in the Department, and so there is not a lot new here. It's just a bit of an additional thrust and some additional specificity on priorities. So I doubt that there is much of anything here that would likely stimulate additional litigation. But it's a good point because as you know from your own experience, in Washington our own experience with the Forest Service, people are not hesitant to sue us these days. They seem to relish that possibility.

With respect to some of the substantive requirements that may emerge from all of this, perhaps the most relevant in terms of potential cost would be the addition of 3 million acres of tree planting, or thereabouts, because that doesn't come free. That needs to be assessed in terms of all the priorities of this country.

We are in the process of doing that, as I indicated to Senator Lugar, in the context of evaluating our existing conservation reserve programs and in the context of looking at forestation and reforestation as a topic of great interest to the administration. But we are definitely conscious of the cost factor that's involved, and one cannot plant an additional 3 million trees without spending some money. So that ought to be considered as you deliberate this legislation.

The third part, the first one you mentioned, Senator Gorton——

Senator GORTON. Three million acres not 3 million trees.

Secretary YEUTTER. Yes, 3 million acres. Did I say "trees"? Three million acres, yes.

The third part, the first one you mentioned, was the question of a learning process. I define learning in a broad sense which encompasses the learning that comes from research. That's probably the heart of this legislation and the heart of what we really need to do in the global warming area. We just simply need to know more, learn more, evaluate more, and, as Dr. Hess said, find ways to be more flexible and adaptable.

It's a fast changing world in both an economic sense and a physi- sense these days, and what this legislation says, and what Dr.

Hess was saying separately therefrom, is that it behooves us to engage in plant breeding programs and other research programs that will give us additional flexibility. If we are in global cooling, then we have to have research products that will function in an environment of global cooling. If we're in global warming, we've got to have research products that will permit us to function in food production and that kind of environment. So we have to be flexible. We can do a lot of that with biotechnology and bioengineering and some of the tools that are presently available to us. But we can't do it without expending the time, effort, and energy.

Senator GORTON. Good. I think you've indicated that it's this first goal which is the heart of the legislation. Back to that second one again, your view was that it isn't a particular threat because much of what the bill calls for consists of activities in which the Department is already engaged. To the extent that this bill asks for amendments to the National Forest Management Act, is that an implication on your part that such amendments are unnecessary because the goals which are sought in the bill are items which you feel the Forest Service already has the authority to engage in and is engaged in?

Secretary YEUTTER. We have someone from the Forest Service here. I think it would be appropriate if we had them speaking for themselves. Eldon Ross, come up and take a microphone, if you would, and respond to that.

Dr. HESS. This is Dr. Eldon Ross, the Associate Deputy Chief for Research.

Dr. ROSS. Senator Gorton, this particular bill would broaden our range of options under the National Forest Management Act, but does not necessarily reflect that it needs to be changed.

Senator GORTON. I am not sure I understand that.

Dr. ROSS. Would you please restate your question?

Senator GORTON. It seemed to me you said two rather different things; that first it broadens your range of authority, but you don't need it.

Dr. ROSS. That's right. The National Forest Management Act does not need to be changed. We have the authority to do much of the activity that's called for right now.

Senator GORTON. OK. I understand that answer, and I think I've run out of time. I believe it's Senator Conrad's turn. Thank you.

Senator CONRAD. Thank you, Senator Gorton.

Mr. Secretary, you've indicated that there's a currency of thought that we've got global warming; on the other hand, people have said to you that perhaps there's more evidence for global cooling. I'm curious. Based on your statement, you indicated 4 of the years in the 1980's have been the hottest in the last 150 years, and CO_2 levels are up substantially from the 1950's. What is your view as to whether or not we're experiencing global warming or global cooling, or are you not ready at this point to take a position?

Secretary YEUTTER. I'll give you a layman's view, for whatever it's worth, which probably isn't very much. Then I will ask Secretary Hess whether he would like to give you a professional view.

My layman's view is that we don't really know and probably cannot know at this point, which leads me to the conclusion, Senator Conrad, that we ought to take some prudent actions that might be beneficial, whichever way the trend happens to lie in the coming years. In other words, there are some actions that we can take here that are going to be beneficial to the environment irrespective of whether the environment is cooling or warming. And we ought to do them just out of prudence, preventive medicine being better than curative medicine.

But I suspect that if there is a trend, it would be toward global warming, but I also believe that it's too early to draw any definitive conclusions. But I'll ask the expert to comment if he would like to do so.

Dr. HESS. I think that what is clearly the fact is that there is a substantial increase in CO_2, a substantial increase in methane, in chlorofluorocarbons, again the effect over Antarctica clearly demonstrated. So there's no doubt that there have been effects upon our global atmosphere that could have profound effects on climate.

I think that the vote is still out in terms of whether we are in a definite warming trend. There's some anecdotal evidence that agrees with that. Some of the models, mathematical models that have been used to test this out indicate it. But I think there is enough evidence that we have a problem and we should begin to address it. It's taken quite a bit of time to reach where we are, but we're reaching higher levels at an accelerating rate. The effects that we are dealing with could be so substantial that it would be very difficult to reverse them. So I think now is the time to begin to address them rather than waiting until someone proves proof-positive that, in fact, we do have a warming trend.

Secretary YEUTTER. I would just add, Senator Conrad, that when one cites numbers like I did at the beginning of my testimony, that we're putting several billion tons of carbon into the air every year, it seems only sensible and logical to conclude that we're polluting the air more than we ought to be polluting, and we ought to stop. It just seems that we ought to have greater sensitivity to future generations than we have demonstrated in recent years.

Senator CONRAD. Well, let me just pursue this by saying that obviously it's imperative that we know if we're to take action that meets whatever the challenge is. And if it's global cooling, I suspect that would call for one set of actions; if it's global warming, that would call for another. And so it's critical that we engage in whatever research is necessary to ascertain what is the truth.

What is the research effort that is under way that would tell us conclusively, at least in terms of your judgment, what we can expect, whether it be global warming or global cooling?

Secretary YEUTTER. I'd like to ask Dr. Hess once again to expand. But it seems to me that in our research efforts, we should be able to cover both possibilities. In other words, we ought to be developing some crops and products that will function well in a cooler environment, being more cold-resistant than what we have today, in hybrid corns, for example. And we should have some that will function also in a hotter environment, so that if the trend is toward global warming that we'll have greater resistance to heat and greater drought resistance if that accompanies the global warming trend as would be likely.

Dr. Hess.

Dr. **Hess**. I would also add that some of the basic mechanisms that gives stress tolerance to organisms may affect both low temperatures and high temperatures as well as drought tolerance. Understanding the basic mechanisms by which organisms withstand stress may have applications both ways.

In terms of how are we measuring or determining whether we are in a warming trend or not is really, to my knowledge, not part of the Department's responsibility but other agencies such as NOAA, DOE, NASA and so forth. And Dr. Gary Evans, who is coordinating our global climate change activity in the Department as well as interacting with other agencies, might be—if you would like to have a response to that question—able to answer it.

Secretary **Yeutter**. Dr. Evans to your right, Senator Conrad.

Dr. **Evans**. Thank you, Senator.

USDA is concerned that some research is ongoing to try to understand what the direction of temperature changes should be. The Forest Service and the Agricultural Research Service both have ongoing research programs that are monitoring and evaluating the current state of various ecosystems, whether these are rangeland ecosystems or forested ecosystems. Both can have indicators in the future of what the direction in either shifts in temperature regimes or moisture regimes could be.

The Forest Service is currently conducting research at the high elevation close to the timber line to see if they can identify some signals that would indicate a movement of the timber line either in a warmer—that is, up slope—or a cooler, down slope direction. Agricultural Research Service is also monitoring rangeland in a similar way.

Senator **Conrad**. When would these studies be complete or when would we get a definitive answer?

Secretary **Yeutter**. Which century, Dr. Hess? [Laughter.]

Dr. **Hess**. You can take that one, Gary.

Dr. **Evans**. Slowly——

Senator **Conrad**. Let me just get out of the way, and all of you can duck at the same time.

Dr. **Evans**. I think the answer to that falls right back to a previous statement of the Secretary and the Assistant Secretary. We probably cannot give you a definitive answer. We may have to wait until our children or our grandchildren can give us that answer, and that is part of our concern at the Department level. The way in which we may need to deal with this will be to initiate some programs that are environmentally useful in today's term in order to stabilize some of the problems that might come down the road.

Senator **Conrad**. Well, let me just say to you that I just came back from my State. I was out in the western part of my State, and I was with a man who had been doing excavating. He said in my State, in the western part where he has been doing excavating, it was dry 15 feet down. He's been doing this kind of work all of his life, and has never seen anything like that. We have a drought now that's in its third year in North Dakota, and the consequences are staggering.

We got through that first year because people sold inventory. This year it was spotty. But I'll tell you, it is absolutely nightmarish out there, and I have no idea whether this is global warming—I have no idea. But all I know is what we're faced with, and if there is global warming—and I understand just a couple of degrees difference could make a dramatic difference in terms of drought pattern—the consequences in just a couple of years can be dramatic.

I'm seeing it in my State. And if we're going to have to wait for our grandkids to know, obviously that's not going to do us any good. We're going to have to have some way of judging what action is prudent. I guess I've not heard yet how we're going to make those decisions. That's really what I'm trying to get at. How do we make a decision on what's cost effective, whether it's ETBE or ethanol derivatives, whatever it is? How do you make an economic judgment when one big factor out there is so hazy that we don't even know whether we're warming or cooling?

Secretary Yeutter. You can only do it through research, of course, and there will be lots of indicators available to scientists. They'll probably debate all this for decades, I suppose, Senator Conrad. But there may be a generating consensus as time passes when we evaluate the indicators. But as you know, this is a new topic of discussion that's really had significant international attention for only a very short period of time, and that's why there is so much disarray among the scientists as to what is or is not relevant.

So it will probably take at least a few more years before the indicators at least begin to point somewhat consistently in one direction, if then. In the meantime, it seems to me, Senator Conrad, all we can really do is engage in the preventive medicine I talked about earlier: plan as flexibly as we can for whatever direction the trends may be.

You pointed out the immense drought in North Dakota, and there's no doubt about that. At the same time, we have parts of this country that have the highest rainfall levels of all time. So it's very difficult to know what's happening in weather patterns at the moment.

Senator Conrad. Thank you, Mr. Chairman.

The Chairman. Thank you.

Senator Cochran.

Senator Cochran. Thank you, Mr. Chairman.

Let me compliment the Secretary of Agriculture. I think the statement that's included in the prepared remarks that have been given to the committee, on page 2, which says that the Department has a strong commitment to "provide an economically and scientifically-sound basis for assuring the integrity of the agricultural and forestry sectors of our economy in a changing global environment." I think that's very appropriate for us to consider, and I think if there's anything wrong with it, it may contain an overabundance of common sense. And that's unusual here in Washington, to be motivated by such a thing as that. Rather, we are more prone to sort of sense what the wind direction is and how strongly it's blowing and then make decisions and develop policies based on those attitudes—whether they're right or wrong. But just the fact that they are held, and strongly held by some, will influence the Congress to do things or an administration that may not be necessarily in our Nation's best interest or in the world's best interest.

So I'm reassured by the tenor of your comments and by your re- to the questions that you have been asked so far. You know, it throws us off balance when we hear things like we've already heard today that we may not be in a situation where there's global warming but it may be global cooling. And everybody thinks, oh, my goodness, you know, how can we deal with this uncertainty? Well, there is a lot of uncertainty in the world today, and we must deal with it, and we will.

I was thrown off balance the other day, for example, in discussion I had with a friend about the Clean Air Act that's before the Senate, and we are working to try to sort through all the suggestions in that legislation to try to do something sensible, correct, that deals effectively with environmental problems and has the concern of economic realities mixed in with it as well.

Anyway, the question was acid rain and what do we know about how we can correct the problems being caused by acid rain. And someone said, well, you know, pine trees have an adverse effect and contribute to acid rain. Well, that threw me completely off balance because I have been committed to the notion that trees are good. In our Southeastern region of the United States, pine trees are not only good, they are excellent. [Laughter.]

We need to grow more of them, and we have forestry incentive programs where we actually pay people money to reforest and to plant trees. Our Conservation Reserve Program has as one of its elements the effort to encourage more planting of trees.

So I really want to have the advice of the scientific community, those people who understand, maybe, what is causing some of these changes that we are experiencing, and obviously we are experiencing change. Senator Conrad talked about the dramatic changes that are occurring in North Dakota. I thought back to a book I read about Theodore Roosevelt who came out to North Dakota to raise cattle one time, and I remembered the experiences that he had in that endeavor. He probably would like to have known in advance that there was going to be such terrible winters and that his cattle would die or freeze.

Senator CONRAD. The winters aren't bad. I didn't say anything about the winters. [Laughter.]

Senator COCHRAN. It gets cold in the wintertime there, and it still does. And it gets warm sometimes in the summertime there.

The CHAIRMAN. Where?

Senator COCHRAN. In North Dakota.

The CHAIRMAN. It's not that cold. Maybe the wimps think it's cold. [Laughter.]

Senator COCHRAN. I know it gets cold in St. Johnsbury, Vermont, too. I've been there.

Mr. Secretary, my question is this: Do you feel that there is the funding and the authorization from the Congress that the Department needs to fulfill the commitment that you describe on page 2 of your prepared statement? Is there something that we can do to help—that's my question—that we're not doing? Or are we doing some things that we think are helping that are hurting the cause?

Secretary YEUTTER. I do not want to make budgetary priority determinations here today, Senator Cochran, which would interfere in any way with your judgment and your responsibilities on the Appropriations Committee, nor with the Office of Management and Budget. But with that caveat aside, let me say that there is no doubt that we need more research in this and a number of other areas. As you well know, Assistant Secretary Hess has been suggesting a national research initiative that would, as I put it, take us into a quantum leap forward in knowledge and technology and agriculture, because we've really given short shrift to that effort over the last, oh, 20 or 30 years perhaps.

I agree with the thrust of that. His suggestion has been that we spend an additional $500 million per year over the next several years to work on areas like the one that we were just talking about here today. Now, $500 million a year is a lot of money in a time of budgetary crunches and a Gramm-Rudman target that goes back to $64 billion next year. So we have to face the realities of the budget, as you know much better than any of the rest of us here today.

Nevertheless, the need is there, and here is one in which we have the future of generations of people in our hands. We're talking about what kind of life our children, grandchildren, and other generations will have, and research could be crucial to the very survivability of this planet. But, Dr. Hess, would you like to add to that?

Dr. HESS. Oh, I support that very much. [Laughter.]

Secretary YEUTTER. Now all we have to do is figure out how to find the money.

Senator COCHRAN. You don't support that statement about pine trees, do you? [Laughter.]

Or is it true?

Dr. HESS. There are certain emissions of hydrocarbons from mature trees that give the blue haze to the mountains occasionally.

Senator COCHRAN. The Smoky Mountains.

Dr. HESS. The Smoky Mountains, yes.

Secretary YEUTTER. Go no further than that. [Laughter.]

The CHAIRMAN. I want you to know that we're still harvesting the pine trees on my tree farm in Vermont.

Dr. HESS. We are in a very challenging time, and I think that the goals of trying to develop an agriculture which is sustainable, less dependent upon some petroleum products in some cases, to be internationally competitive and at the same time contributing to improvements in areas such as global climate change is a big challenge. We feel that an investment in research can help address a number of those problems.

One issue has been referred to earlier in terms of the tropical forests. I think there is an opportunity for the United States to help in terms of developing a sustainable agriculture in the tropical areas so that the practice of slash and burn would be reduced. So I think we have to offer help in order to convince other nations to reduce their practices as well. We also have interest in this area because it's a rich course of germ plasm, and with the new tools of molecular biology, we would like to be able to have access to new genetic materials so that we could develop genetic resistance to insects and disease, which, again, would answer some of the challenges that we have in terms of food safety or the use of petroleum products in production systems. So they are all very much interconnected.

Senator COCHRAN. Thank you very much.

Thank you, Mr. Chairman.

The **Chairman**. Thank you, Senator Cochran.

Senator Bond.

Senator **Bond**. Thank you, Mr. Chairman.

I think I would like to go back to Senator Cochran's question about the killer trees for just a minute. [Laughter.]

I came in set to brag on my hometown of Mexico, Missouri, which has been Tree City, U.S.A., for 10 years. We've got a reforestation program——

The **Chairman**. What was the name of that town?

Senator **Bond**. Mexico, Missouri, home of Miss America. You may remember that.

The **Chairman**. This is the real name of a place?

Senator **Bond**. Mexico, Missouri. Yes, sir. It's the saddlehorse and fire clay center of the world, too.

The **Chairman**. This must be a fascinating place. What else? [Laughter.]

Senator **Bond**. We'll be happy to host another hearing of the Agriculture Committee. We were delighted to have you in Platte City, and we would welcome your visit out there. But I was going to tell you about Missouri. I believe the Secretary knows about the Operation Tree Program (Trees Renew Energy, and the Environment) that the State of Missouri is working on. We're very pleased with these programs, and I've talked with the Secretary about some of the things that we're considering in the Conservation Subcommittee. We are particularly interestod in encouraging the planting of more trees on the CRP land to get up to the 12, 12.5 percent target. But at lunch today, I happened upon a conversation of a number of my colleagues, fellow Senators, who were talking about a study apparently which just came out, which did raise questions about the contribution that some trees make to either global warming or pollution. They were saying that elm trees were a particular problem.

I would like to have Dr. Hess or someone——

Secretary **Yeutter**. Let's get our Forest Service folks up here.

Senator **Bond**. Let's get this problem laid out and settle this thing so we——

Senator **Conrad**. Could you just yield on that just for one moment?

Senator **Bond**. Do you have any smart cracks about Mexico, Missouri?

Senator **Conrad**. No.

Senator **Bond**. I'd be happy to yield to you.

Senator **Conrad**. The President just came to North Dakota and planted an elm tree, and it was covered with gypsy moths.

Senator **Bond**. Kent, do you think you got the message? He was trying to tell you something.

Senator **Conrad**. Maybe it's connected to this study.

The **Chairman**. We had to get them out of New England somehow, Kent. [Laughter.]

We just didn't think you'd catch on so quickly. We tried to tell you they were butterflies.

Secretary **Yeutter**. I think that is part of the Democratic misery index. [Laughter.]

The **Chairman**. It's only Monday, and we're falling apart already around here.

Senator BOND. What is the problem, what is the scientific basis for the concern about the tree emissions?

Dr. ROSS. Senator Bond, I think if you're talking specifically about pine trees and the hydrocarbon emissions, the problem is they do emit some volatile hydrocarbons which can contribute to ozone formation in the atmosphere. This is a natural process that has gone on for many years, but it's——

Senator BOND. Well, how do you measure the problems caused versus the benefits? And is it confined? Are some trees more of a problem than others, or is it an insignificant contribution?

Dr. ROSS. I think all trees contribute volatile hydrocarbons to the atmosphere. Now, I think the proportion of hydrocarbons that they contribute, though, is probably going to be insignificant in relation to the amount of other anthropogenic pollutants that are put into the atmosphere.

Senator BOND. Well, is there a ratio—we've heard about the ability to sequester CO_2. Now, if that's the proper term, let's use it.

Dr. ROSS. That's right.

Senator BOND. Are we talking about a scale of 10 to 1, 50 to 1, 100 to 1? How do you rank the positive contributions versus the negative impact?

Dr. ROSS. Well, that's a hard question to answer. I think we could probably provide an answer for you for the record.

Senator BOND. Mr. Chairman, if you wouldn't mind, since this is being discussed, I would welcome a response, if you could state it so simply that we could understand it, it would be a real help, because this has been bounced around some, and I think we might as well deal with it once and for all.

The CHAIRMAN. A response here or one for the record?

Senator BOND. One for the record later on, if you would provide a written response, it would be helpful so we won't have to worry about that problem.

[The response was subsequently provided and follows:]

UNITED STATES DEPARTMENT OF AGRICULTURE,
FOREST SERVICE, WASHINGTON OFFICE,
Date: December 11, 1989.

Reply to: 4400-1

Honorable CHRISTOPHER BOND,
United States Senate, Washington, DC 20510.

DEAR SENATOR BOND: During hearings on S. 1610, the Global Change Prevention Act, you asked for information on the scientific basis for concern about tree emissions of volatile hydrocarbons, problems caused by tree emissions, and benefits of trees.

All living vegetation emits volatile hydrocarbons as part of the respiration process. Oxygen and water vapors are also emitted for vegetation in the photosynthesis-respiration process. Carbon, in the form of carbon dioxide (a greenhouse gas), is taken up by vegetation and converted to plant sugars and fibers through photosynthesis. In fact, all of the carbon in vegetation comes from atmospheric carbon dioxide. The very fact that trees increase in volume and weight is a clear indication that more carbon is removed from the atmosphere than is returned to the atmosphere.

Volatile hydrocarbons from vegetative and numerous anthropogenic sources can combine with nitrous oxides to form oxident air pollutants, chiefly ozone, in the presence of sunlight. Nitrous oxides are the result of high temperature combustion, the major source being combustion of fossil fuels.

Ozone is formed only when oxides of nitrogen are present. Sunlight and vegetation produced non-methane hydrocarbons are part of our natural environment. Nitrous oxides in the atmosphere are primarily a result of fossil fuel use.

Worldwide, natural emissions of non-methane hydrocarbons are approximately six times of anthropogenic sources. In the United States, approximately 58 percent of the non-methane hydrocarbons are from natural sources, while 42 percent are from anthropogenic sources. These elevated emissions of anthropogenic hydrocarbons and nitrous oxides, particularly in urban areas result in elevated levels of ozone. In rural areas, where nitrous oxides are absent, there are low levels of ozone.

As a general conclusion, vegetation removes more carbon from the atmosphere than it returns to the atmosphere. Oxygen and water vapors are essential to human life and emitted by vegetation. The harmful side effects of ozone production is more a result of fossil fuel consumption than from hydrocarbon emissions from vegetation.

Please let me know if you would like additional information.

Sincerely,

ELDON W. ROSS,
Associate Deputy Chief for Research.

Secretary **YEUTTER**. I think it's safe to assume, Senator Bond, that we're going to come out in favor of trees. I'd say the tradeoffs are going to tilt in that direction.

Senator **BOND**. Does that have anything, Mr. Secretary, to do with your ability to have dinner cooked for you tonight when you get home since Mrs. Yeutter is involved in the tree-planting program? [Laughter.]

Secretary **YEUTTER**. Perhaps.

Senator **BOND**. I thought that you would come out on that side.

Let me ask a question about the contribution to global warming. Mr. Secretary, I missed your testimony, but there is a finding in the bill that an urban tree is 15 times more efficient and more effective than a forest tree in reducing the buildup of carbon dioxide emissions. Does this imply that if we really are concerned about global warming, the benefits that come from urban tree-planting, the reforestation, and the CRP efforts, are far more significant in terms of general soil conservation? In other words, if we're allocating dollars to deal with global warming, we ought to be putting the money into urban tree-planting. Is this a fair assessment?

Secretary **YEUTTER**. I will again ask Dr. Hess to add whatever he'd like, but there is no doubt that we receive major benefits from urban tree-planting because that is where a lot of the air pollution lies, and the ability to absorb carbon is so important in those areas. The more trees, the more carbon that can be immediately absorbed in the immediate vicinity of any urban area. So we do get a significant payoff in terms of protection of the environment through urban tree-planting. We also get benefits from rural tree-planting, but the magnitudes from this standpoint are not as great.

And I might add that we feel that a lot can be done in the way of urban tree-planting with a relatively limited expenditure of Federal funds because there ought to be ways to motivate urban citizens and urban officials to get involved in these programs without huge expenditures of Federal moneys. Whereas, when we're talking about the Conservation Reserve, there certainly has to be the financial motivation to achieve additional tree-planting out in rural areas.

Dr. Hess.

Dr. **HESS**. I guess the other thing, Senator Bond, would be the effect of trees on providing shade, reducing the utilization of energy for cooling, evapotranspiration—that is, as the moisture evaporates from the leaves, that has a cooling effect. It prevents the asphalt, for example, from absorbing heat, which is re-radiated back. So these all have very positive effects in terms of the total energy utilization and gives an added advantage for urban tree-planting.

In terms of the CO_2 absorption, I would expect that it is due to the fact that generally the CO_2 levels will be higher in the urban areas than in the more rural areas. But I don't think—in terms of the ability to fix CO_2 overall, I think we need to depend upon both urban planting as well as the rural planting.

Senator **Bond**. Referring to another section of the bill in which the methane emissions of irrigated rice cultivation are cited as a major concern, is this an area which we need to be doing more research? Is this an area that we ought to include in this study?

Dr. **Hess**. Yes, it is, Senator Bond. The observations have been that the methane levels over the years have remained fairly constant until recent years in which it has picked up quite dramatically. And that has been associated with the expansion of rice cultivation, particularly under flooded conditions rather than upland, dry culture of rice. Since such a large proportion of the world's population is dependent upon rice as a staple, I think this is an area that does need to be addressed.

Senator **Bond**. Finally, there's a subtitle in this bill dealing with the Conservation Reserve Program and how to encourage more planting of trees. Mr. Secretary, you and I have had the opportunity to discuss this from time to time. I've shared with you concerns raised by farmers in my State that front-end cost-sharing for tree-planting may not be the most effective way to assure a strong stand of trees or a good forestation process because of the fact that unless these trees are well cared for over a significant time you may lose a significant number. Have you had any further conversations or had any more ideas on how you might encourage tree-planting under the CRP?

Secretary **Yeutter**. I have nothing to add to our conversation, Senator Bond. I did mention earlier in my testimony today that we are intensely evaluating that question and hope to have views and recommendations for the Congress on that point, for the farm bill debate or separately therefrom. But we have not crystallized our thinking fully yet.

Senator **Bond**. Thank you, Mr. Chairman, and thank you, Mr. Secretary and Dr. Hess.

The **Chairman**. Senator Boschwitz.

Senator **Boschwitz**. When one speaks about the CRP, Mr. Secretary, when we allowed haying under the CRP, that was not allowed during your tenure. But that caused——

Secretary **Yeutter**. This year. We did it this year.

Senator **Boschwitz**. We did it again this year. That's right. But as long as we do that, I think there will be less of an inclination on the part of farmers to plant trees.

Secretary **Yeutter**. Yes, that's correct.

Senator **Boschwitz**. Not having read the bill as my colleague from Missouri has done, but rather just outlines of it, I was interested in the 15 times. The 15 times the absorption of CO_2, is that a proper number? Or does that include also the advantages because it shades and——

Dr. HESS. Let me ask Eldon to give the answer to that question.

Senator BOSCHWITZ. He asks you and you ask him.

Secretary YEUTTER. It happens we are specialized, Senator Boschwitz. We're all specialized.

Dr. ROSS. Senator Boschwitz——

Senator BOSCHWITZ. Would you be kind enough to say your name?

Dr. ROSS. I'm Eldon Ross, Associate Deputy Chief for Research in the Forest Service.

I think that figure is approximately correct. What you need to take into account here is the fact that trees can account for a lot of long-term storage of carbon. It's tied up not only in the stem but in the root system for a long period of time. Even if the tree is cut and utilized, that product, before it is destroyed, continues to sequester the carbon.

Senator BOSCHWITZ. But, as I understand it, a mature tree also sequesters carbon? Or is there a decline in the sequestering?

Dr. ROSS. Once a tree reaches maturity, the rate of sequestration does begin to decline.

Senator BOSCHWITZ. I was wondering where we got that word, Mr. Chairman, in some of our other endeavors around here.

The CHAIRMAN. It's much involved these days.

Senator BOSCHWITZ. I was interested in that because I note that there was a utility, I believe in Connecticut, that built a plant and offset its production of CO_2 by planting, I forget how many thousands of acres in Guatemala. At that time I was told that it really doesn't matter where you plant the trees because, you know, air knows no borders nor does water. Would you comment on that?

Dr. ROSS. Well, I assume that if you consider the globe truly a single environment, then, in time, mixing patterns are going to move the gases around the place where that would be true. But I can't comment on the——

Senator BOSCHWITZ. Are you familiar with that example?

Dr. ROSS. I've heard that example. Yes, I have.

Senator BOSCHWITZ. Do you think that——

Dr. ROSS. I assume it's possible, yes.

Senator BOSCHWITZ. Who does he ask when——

[Laughter.]

Senator BOSCHWITZ. Let me thank you——

The CHAIRMAN. That reminds me of a joke which I can't tell here. I'll tell you later.

Secretary YEUTTER. Everyone has a guru, Senator.

Senator BOSCHWITZ. Let me say, Mr. Secretary and Dr. Hess, that I have been somewhat involved in the business of global warming, and I've always felt that we have to get ahead of the front end of that curve. It's amazing to me what difference a few degrees makes. I was told once—and please correct me if I'm wrong—that at a time when the Earth was 9 degrees cooler, that New York was under 3 kilometers of ice and that a few degrees indeed makes a great deal of difference. So I've taken the attitude that I'm willing to take some risks and expend some funds for the purpose of getting out in front of what I perceive to be the problem. Perhaps it's somewhat irresponsible to say, but I'm willing to take action almost before all the proof is in. The proof in most matters seems to be so two-sided that I don't want to let time go by. I've always presumed that you just can't spew all this stuff into the atmosphere without having some effect. As you see standards of living grow in Asia, and I read this morning that each year in India, 17 million new people are born. So there's a great deal of need to consume fuels, and that's going to get worse.

I was a member of the U.N. delegation from the Senate. Senator Kerry of Massachusetts and I represented the Senate. I only agreed to go if I could speak about global warming. I did go to the U.N., and after a very substantial negotiation with the State Department, that didn't want to even admit that it was taking place, I made a speech about global warming and have tried to be active and move forward with Senator Gore and others in that regard. My attitude is we ought to get on the front end of that curve, and that it's an important thing to do because there may be some irreversible trends taking place.

I didn't see that addressed so much in your testimony, Mr. Secretary.

Secretary YEUTTER. We covered it at some length earlier in this hearing, Senator Boschwitz, before you arrived, and fundamentally said "Amen" to what you've just articulated. I pointed out that there is a wide divergence of views among scientists as to whether we do or do not have a global warming trend. But irrespective of that divergence, we ought to do what is prudent under the circumstances, and we ought to be cautious because of the interests of all the inhabitants of this globe. Therefore, a bit of preventive medicine would seem to be in order.

Senator BOSCHWITZ. Thank you, Mr. Secretary. I assume you agree with him because I presume that you told him. [Laughter.]

Dr. HESS. We agree.

Senator BOSCHWITZ. But let me change the subject just a little bit, Mr. Secretary, to an area that I know that you're quite familiar and concerned with. We are not the only people who use agricultural chemicals. And as a matter of fact, our use of agricultural chemicals is substantially less than our friends in the EC.

Secretary YEUTTER. Yes.

Senator BOSCHWITZ. I have gone across some of their fields, and you see the paths where their machines go as they fertilize wheat 11 or 12 times. They get wheat yields like we get corn yields. It is just amazing.

I've always thought—and I know that the Dutch and others are having some problems with contamination of one type or another or ecological problems. I've always thought that at some point the thing that would drive the Europeans into negotiations is that they are so seriously imbalancing their own environment.

Secretary YEUTTER. Yes.

Senator BOSCHWITZ. Now, I'd like you to comment on that and tell me whether or not it's their soils that are different and, therefore, that they can take all this abuse, all these chemicals; or if there is something to the idea that the Europeans simply can't keep this up over an extended period of time?

Secretary YEUTTER. It's a very good point, Senator Boschwitz, and is one that I have discussed with representatives of the Euroan Community at some length when I was in Europe in September. I did that because I likewise concur that this has relevance to the negotiating environment in which we both find ourselves today. And if Western Europe can reduce its levels of inputs in agricultural production via a negotiated outcome in the Uruguay round, it would seem to be beneficial for them to do so. Not only would this ease some of the burdens of surplus disposal and their undercutting world markets through the use of export subsidies, but it would also achieve environmental benefits simultaneously therewith. So my argument has been why don't you use some of your need for additional environmental protection to achieve production reforms as well.

Without question, the Europeans are moving into a situation where their environment is in more jeopardy than would be many other areas of the world, including the United States; that it can be observed through their difficulties with trees in much of Western Europe; it can also be observed through their difficulties with ground water pollution in substantial areas of Western Europe.

Senator **Boschwitz**. Birds.

Secretary **Yeutter**. And birds as well.

Senator **Boschwitz**. I understand that in some parts of Europe you no longer hear the birds sing.

Secretary **Yeutter**. Yes. Why is that happening? Is their soil any different? My judgment is that our soil is at least as fertile as the soil of Western Europe. The difference is the tremendous production incentives that the community builds into its farm programs. If one provides a high enough price support level, farmers will obviously respond to that through careful economic calculations, which would suggest higher levels of input.

Senator **Boschwitz**. Sure. I understand that. But are the inputs that they're putting into the soil so eroding their own ecological balance that they will be driven to moderate that?

Secretary **Yeutter**. Yes. And in my view, that's now finally beginning to happen. In fact, in some countries, we're seeing programs develop on somewhat of an isolated basis so far to encourage, even with financial incentives, encourage farmers to reduce their level of input usage. There now are some financial incentives that are designed to result in extensive agricultural production or less the intensity than it is today.

Dr. **Hess**. In England, there is a proposal to regulate the amount of nitrogen fertilizers that farmers could use based upon the nitrate content in their wells. In some areas, they would prohibit the use of nitrogen fertilizers, so that's an example of where it had reached such a state that they were actually resorting to regulations to affect farming. We hope with the water quality initiative and so forth that we can voluntarily modify our practices so that we don't reach the stage that we have to have regulation so we can do it by best management practices.

Senator **Boschwitz**. You expect them to reach that stage in broader areas of Europe? When I think of Europe—West Germany, for instance, is about the size of the State of Minnesota, 2½ times the size of Indiana and 10 times the size of Vermont, and they have 60 million people.

The **Chairman**. If you ever flattened out Vermont, it would be bigger than all of them put together. [Laughter.]

Senator **Boschwitz**. I'm going to have to ask for the regular order here. [Laughter.]

The **Chairman**. And I'll rule on it. [Laughter.]

Senator **Boschwitz**. And there instead of having 4.25 or 4.5 million people as we do, they have 60 million people. They have little farms, and they have large production, and they really pour on the fertilizer. In your judgment, Dr. Hess, are they going to call a halt to this or cause it to be lessened within the next 5, 10 years? Will they have to?

Dr. **Hess**. Yes. As the Secretary has indicated, I think this is an area of growing concern. It's not only in the European but Eastern European countries as well. Before coming to Washington, I was on a couple of National Academy of Science panels looking at agriculture and the environment in Czechoslovakia and Hungary, and there they are also very concerned about the effects of current agricultural practices on the environment, including ground water. So they're experiencing the same thing. For better or worse, the activities of the greens in Europe certainly will have an impact upon decisionmaking.

Secretary **Yeutter**. They are behind the learning curve, Senator Boschwitz. Because of their much higher levels of input usage, they should have been contemplating the need for adjustment several years ago. They're doing it now about the same time we're beginning to carefully evaluate this situation. But it would have been much better from their standpoint had they begun to confront this challenge a decade or so ago rather than today.

Senator **Boschwitz**. Well, I thank you, Mr. Chairman. I thank the Secretary and Dr. Hess. And I apologize to the other participants in the hearing this afternoon, but I'm going to have to leave.

The **Chairman**. Senator Boschwitz, thank you for coming in. I know the Secretary has to leave, too.

I'd just note for anybody's interest, we asked the Congressional Research Service to do a summary of material available on global warming, and they responded earlier this year. I'll just read from their summary.

It says:

> * * * This increase in CO_2 levels may now be great enough to affect the Earth's processes of temperature regulation, with the net effect of increasing temperatures through a process similar to that in a greenhouse. * * *
>
> If such an effect has not yet occurred, it will probably do so within a few decades, according to current scientific thinking.[1]

What CRS found in the material they went through is that all trends are toward warming. I think all agree that there are trends out here, and if we ignore them, we're ignoring them at our peril. As I said before, we have really two levels. On seasonal crops, it's well to know if we have a warming because we can make fairly quick adjustments. It's easier said than done. Sometimes it may require changing a basic economy of an area and methods of farming. But at least we can plan for it.

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[1] See page 3 of the committee print, Agriculture, Forestry, and Global Climate Change—A Reader, 101st Congress, 1st Session, S. Prt. 101-26, from the statement on Global Climate Change: The Science, Sources, Agricultural and Forestry Impacts, and Proposed Policy Responses, by David E. Gushee, Robert E. Morrison, and John R. Justus, Congressional Research Service.

On the long-range planning, though, in forestry, that's where we have a real concern. You're not even talking about 10 years or 20 years; you're talking about 40 and 50 years' planning and changes. I know we all agree on this. We would be neglectful in our duties if we did address just that issue.

Dick, do you have anything to add?

Senator **Lugar**. No. Thank you.

The **Chairman**. OK. Good to have you here.

Secretary **Yeutter**. Good to be here.

The **Chairman**. Thank you very much.

[The prepared statement of Secretary Yeutter follows:]

Statement of Clayton Yeutter
Secretary of Agriculture
Before the Senate Committee on
Agriculture, Nutrition, and Forestry
November 6, 1989

Good afternoon Chairman Leahy and Members of the Committee. I welcome the opportunity to appear before you today to present the views of the U.S. Department of Agriculture on the issue of global climate change and its potential impact on American agriculture.

For the past several years we have heard and read much about changes in climate, and what these changes might do to the world in the coming years. There is no doubt that our climate is changing. It has been changing since the beginning of time, and will continue to change in the decades ahead.

Today, however, we are concerned that climatic changes may be accelerated by the acts of man, particularly those changes which occur through increased use of fossil fuels and renewable resources. The concern is that increases in carbon dioxide and other trace gases could result in what is commonly referred to as the "greenhouse effect."

Unfortunately, there is great scientific uncertainty about both the likelihood and significance of such potential climatic changes. There is great uncertainty about how soon such changes might begin and about the rates at which they might occur. Given those uncertainties, there are even greater uncertainties about what the impacts might be on human activities and interests.

The Bush Administration is fully aware of this potential challenge. One of the first initiatives the President took at the very beginning of his Administration was to request a very substantial budget increase for a coordinated interagency research program on global change.

The Committee on Earth Sciences (CES) of the Federal Coordinating Council on Science, Engineering, and Technology has taken the lead role in designing and coordinating the Global Change Research Program. The CES recently published a report, "Our Changing Planet: The FY 1990 Research Plan." The CES and its member agencies, including the Department of Agriculture, have done extensive work to prepare an FY 1991 Global Change Research Program budget which will ensure a scientifically strong and credible interagency program.

Mr. Chairman, I note with interest the potential impact of global change on agriculture and forestry. The Department of Agriculture is cognizant of the need for direct involvement in addressing this issue. To that end, we have been an active participant in the CES planning and coordination efforts. We also have an active role in implementing certain key parts of the global change research program.

Contained in the CES research plan is a summary of USDA activities which states, "USDA conducts research to assess the effects of global climate change on the agricultural food and fiber production systems and on forests and forest ecosystems of the United States and worldwide, including, but not limited to, basic research on the biological response mechanisms to increasing 'greenhouse' gases; improvement of plant and animal germ plasm to respond to global change; and development and implementation of plans for terrestrial mitigation systems to ameliorate the observed increases of greenhouse gases, including crops and forests. An additional responsibility shall include research on applications of agricultural climatology to improve management decisions and conservation of resources, while maintaining quality and quantity of crop yields."

To date, much of our research activities have focused on the implications of ultraviolet light on plant growth. This basic research will contribute to our ability to develop a scientifically-sound basis for assessing, predicting, and managing potential impacts of stratospheric ozone depletion on crop production.

We are also concerned with the impacts of other changes in the composition of the earth's atmosphere on agricultural production. In the forestry area, the U.S. Forest Service is embarking on an accelerated program to develop the knowledge needed for promoting forest health, productivity, and diversity in a changing atmospheric environment. The objective is to provide the scientific basis needed to address broad questions on the effects of physical and chemical climate change on forest, range, and related ecosystems. The Forest Service is in a unique position to carry out this type of research which involves collection of data on a long-term basis.

One area of particular interest to American agriculture is the use of agricultural products to replace fossil fuels. We need to have available technology to assist in the shift to biofuel sources which are developed and produced from the byproducts of agriculture and forestry. Ethanol, already available in the commercial marketplace, is but one example. Ethanol-based derivatives, such as ETBE, and extracts from other crops also have the potential to reduce our dependency on fossil fuels, thus assisting in the reduction of carbon dioxide emissions.

Mr. Chairman, I have provided this brief description of our involvement in research on global change to emphasize our concern about the potential impact on agriculture. We must continue to protect the sustainability of our agricultural and forestry resources. In order to further enhance this goal, we are developing a strategic plan for the Department, and we are beginning to take a serious look at the development of new soil and water conservation systems, improved forest management systems, and to employ biotechnology in the breeding of temperature tolerant and drought resistant-plants.

As this problem is by no means confined to the United States, we are already working within the international community to share and exchange information and technology. The United Nations Environmental Program and World Meteorological Organization are two of the major groups in this effort, working under the Intergovernmental Panel on Climate Change. And, it is interesting to note that there is in place a US-USSR Working Group on Climate.

I might also add that farm policies--both here in the U.S. and around the world--which encourage the production of commodities already in surplus through petroleum-intensive production practices, may be contributing to the problem of climate change.

Mr. Chairman, this summary demonstrates the strong commitment of the Department of Agriculture to provide an economically and scientifically-sound basis for assuring the integrity of the agricultural and forestry sectors of our economy in a changing global environment.

I commend you for addressing the issue of global climate change. The Department understands your interests, we are already attempting to respond to them. We concur with the basic thrust of your legislative proposal. Though much of what it encompasses can be done administratively under existing authority, we will be pleased to provide more specific analysis and recommendations at a very early date.

I thank you and the Members of the Committee for providing me with the opportunity to present the views of the Department. I will be happy to respond to your questions.

The **Chairman**. Actually, why don't we bring Mr. Sampson's and Mr. Greenwalt's name tags up here so I don't need to have binoculars.

I might say, gentlemen, of your prepared testimony, Mr. Sampson, your prepared statement will be placed in the record, of course, but you might want to digress even at the outset and address yourself to the issue of trees and pollution.

STATEMENT OF R. NEIL SAMPSON, EXECUTIVE VICE PRESIDENT, AMERICAN FORESTRY ASSOCIATION, WASHINGTON, DC

Mr. **Sampson**. Thank you, Mr. Leahy.

I am Neil Sampson of the American Forestry Association, and I'm grateful to get the chance to come before you and Senator Lugar.

THE ISSUE OF TREES AND AIR POLLUTION

After hearing the last hour-and-a-half, I think there are a couple or three issues we need to address. The first one was sort of the killer trees issue, the issue of trees and air pollution. That's an issue that's been around for a long time, and let's talk about it for just a minute.

It is true that trees produce natural hydrocarbons and that many of those hydrocarbons are reactive. It's also true that in the presence of sunlight and driven by heat nitrogen oxides and hydrocarbons produce ozone and smog. Therein is where the rub lies. A hydrocarbon source, whether it's from a tree or from an automobile exhaust, and a nitrogen oxide source, whether it's from an auto exhaust or a powerplant stack, in the presence of heat and sunlight will produce ozone and smog.

That research was done to focus on the current control strategies of the Environmental Protection Agency, which have almost entirely aimed at reducing the hydrocarbon emissions from automobile tailpipes. It has demonstrated that, in areas where there were heavy concentrations of trees, there is sufficient natural background of hydrocarbons so that spending a lot of money to reduce hydrocarbons from tailpipes is simply not going to take the appropriate mix out of the air. The control emphasis will have to switch to nitrogen oxides.

In talking about how that takes place, however, we can also talk, as Senator Bond mentioned, about the positive effects of trees. The smog-formation process is driven by heat. There are almost no instances where a city in the United States exceeds the ambient air quality standards for ozone and smog at under 74 degrees, and there's seldom one that fails to violate standards when temperatures exceed 92.

Our urban communities today have a 4- to 9-degree heat island effect from the development that has occurred. That heat island effect is highly amenable to reduction through increases in urban trees, not just numbers of trees, but the canopy cover as well.

In Washington, D.C., for example, we estimate that it costs urban consumers $10,000 an hour for every degree Fahrenheit of that heat island. We have 4 to 5 degrees of heat island effect in Washington, D.C. It's going up about a degree a decade. We can't eliminate it all with trees, but we can get about 2 degrees, it looks like, with an improved urban tree-planting and management program.

That's $20,000 an hour on a hot summer afternoon, and I don't know what the cumulative total for a summer would be. You would have to look at the degree days. But the truth of the matter is, we can both make urban living conditions more pleasant and reduce smog formation by that cooling effect. So trees have a positive effect on pollution, and also can, if we fail to control nitrogen oxides, provide one of the three ingredients needed for that smog and ozone formation.

THE CARBON DIOXIDE IMPLICATIONS OF TREES IN THE CITY

The other thing that was talked about was the carbon dioxide implications of trees in the city. The estimate that an urban tree is 15 times more effective at reducing atmosphere CO_2 buildup than a rural tree comes out of the energy research at the Lawrence Berkeley Laboratories in California. An urban tree and a rural tree grow biologically just about the same way. The carbon that is taken from the air is locked up in the wood, and the amount of wood that's grown is the key to how effective a tree is at sequestering carbon.

But in urban areas, the shading and cooling effect has a tendency to reduce air-conditioning requirements. This creates an energy conservation effect that, in its carbon dioxide implications, is 15 times larger than the direct biological effect of the tree.

So if we want to affect energy conservation and biology simultaneously, we do better forestry in the city. What we need to say, however, is that our total opportunities in the city are far less than our total opportunities in the rural areas, and that nothing we do in the communities can offset the need to continue to do conservation work and better management in the forests, and also to look at conversion opportunities where marginal crop and pastureland can be converted to forest.

STUDIES

Let me just wrap up by saying that the association is undertaking a major set of studies to do a state-of-the-art report about the opportunities for United States forests and forestry to mitigate the greenhouse effect—focusing on the buildup of carbon dioxide and methane. Most of those studies will be available by April of 1990. We don't expect to have all the answers. We aren't even trying to solve the question of whether the increased carbon dioxide and methane is going to cause global warming or global cooling. We think that's a full employment opportunity for computer modelers and climatologists for the next several decades.

What we do know is that global environments are showing some significant imbalance, that global levels of carbon dioxide and methane are going up very rapidly. You don't have to look very hard at the data to realize that the minute the trees start growing in the spring in the Northern Hemisphere, the carbon dioxide levels on Mauna Loa go down. You can look at that data and tell that trees are a very critical part of regulating atmospheric levels worldwide. Their growth and their health is a very critical part. The forest may also be a significant trapper of methane in forest soils, and some research in the Northeastern United States is suggesting that air pollution and artificial fertilization are now reducing that ability.

WE STRONGLY SUPPORT S. 1610

There's a lot we need to know, but what we are here to tell you today is that we strongly support S. 1610. We think this is an attempt to get out ahead of the issue. We've been working a program that we call "Global ReLeaf," Mr. Chairman, for about a year, and I need to tell you that the American public is ahead of you in terms of its willingness to get out and really start to do things to improve the environment. They're not convinced whether global warming or global cooling is occurring. They just know their environment is in trouble. They know that their city is too warm for comfort and that they can help it. They know that their watersheds and other areas can stand improvement, and they're willing to take off and start working to fix those problems.

So we really commend you for looking at S. 1610, for looking at the urban forestry aspects, which are critical, and for looking at ways to reach through to private nonprofit organizations, which we have demonstrated can be a really important partner to government in getting the job done.

We would support you in that effort. I'd be happy to answer any questions you have after we're done.

[The prepared statement of Mr. Sampson follows:]

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TESTIMONY

Presented to

THE SENATE COMMITTEE ON AGRICULTURE

on

THE GLOBAL CLIMATE CHANGE PREVENTION ACT OF 1989

November 6, 1989

Mr. Chairman. Members of the Committee.

I am Neil Sampson, Executive Vice President of the American Forestry Association. Our Association has been promoting environmental improvement through the wise management of trees and forests since 1875. In that 114 years of conservation action, few issues have arisen that are of such importance to the future of forests -- and the environment -- as the issues addressed by the legislation under consideration here today.

S. 1610, the Global Climate Change Prevention Act of 1989 is, along with its associated bill, S. 1611, the International Tropical Forestry and Energy Efficiency Act of 1989, the most comprehensive and constructive proposal for policy response to the threat of global climate change that we have seen to date. We encourage this Committee to give S. 1610 the highest priority for action.

In 1988, as a nation suffering from drought and wildfire began to listen with renewed interest to what atmospheric scientists and climatologists had been saying for many years, our Association began to tell people about the connection between the global warming threat and trees and forests. It is a complex scientific story, but one that can be fairly easily reduced to both simple terms and simple actions.

We are convinced that the American people must begin to take those actions -- actions devoted to mitigating global warming through the restoration and renewal of damaged ecosystems around the world. Some of those actions are fairly simple, and can be started by individuals at their homes and businesses. Other actions will require community effort, and those, too, can begin immediately if people become convinced that action is necessary. In the year since we began our Global ReLeaf campaign, thousands of people and hundreds of communities have responded with new initiatives to plant trees and improve both community and rural environments.

Those individual and community actions underscore, we feel, how essential it is that the United States government take immediate leadership action. People are ready to act, and they expect their government to act. But that action needs to be carefully and thoughtfully designed, because global climate change is an issue that will develop very slowly, over many decades, and national leadership must take that long perspective so that people understand fully what we face.

It is also critical that people understand how vulnerable American agriculture and forestry are to the impacts of climate change. I'm afraid many Americans look on our agriculture as an automatic producer of over-abundance -- a constant public policy problem fueled by never-ending surpluses. They look on our forests similarly -- an unending source of the wood, paper and other products and services upon which we have grown to depend. The people in this room know differently. Our high production is based on the very highly refined technologies we have adapted to a stable, predictable climate range. If the climate moves out of the range where our management technologies are well suited -- or becomes significantly more variable and unpredictable, America's high-technology, high-capital forms of production are as vulnerable to disruption as any agriculture anywhere in the world. In fact, it is arguable that high-technology approaches can be disrupted more easily than more traditional approaches, if only on the fact that they are based on a narrower range of species and genotypes, pushed to the limits of their capacity by highly refined management techniques. They are like a finely-tuned race horse, running great when everything is just right, but sensitive to any significant change in conditions.

Those of us who concentrate our interests on trees and forests have identified several significant connections between climate change and forest management. They include opportunities to increase forest areas and timber growth as one of the responses available to people as they search for ways to slow down the alarming increase of greenhouse gasses in the atmosphere. We would like to outline those opportunities as we see them, and show how S. 1610 could be instrumental in helping Americans take international leadership in a massive new human commitment to the restoration of degraded ecosystems.

We believe, however, that all efforts at mitigation will, at best, only slow down the onset of global climate change. In other words, we have been convinced by those scientists who argue that some change is inevitable. That means we must also look at the other side of the coin -- what research, management and policy responses will be needed to maintain or improve forest ecosystems in the face of a changing climate? We will look at how S. 1610 could be essential in helping prepare forest managers to meet the unprecedented challenges they may face in the next century.

Finally, we will look at the possibility that all this fuss is unwarranted. What if the increase in carbon dioxide slows naturally? Or if natural feedback mechanisms that we don't now understand work to muffle its effect? What if climate goes cooler instead of warmer, or just muddles around and doesn't change enough to make a significant difference in the trends? How much difference will that make? Will it mean that the programs initiated by S. 1610 will have been a wasted effort? We don't think so.

Scientists believe that about 80 percent of the current rise in atmospheric carbon dioxide is due to the huge amounts of fossil fuels we are burning, with the other 20 percent coming from deforestation -- largely in the tropics. If we take that as one aspect of the problem, then the directions for solution seem fairly straight-forward. We must find ways to use energy more efficiently and reverse the trend of deforestation by increasing both the extent and growth rate of forests worldwide. S. 1610 helps start this process.

The proper place to start, for the federal government, is with a greatly expanded research and information program. This needs to be a broad-based effort that looks at all ways in which forests can be improved and deforestation trends reversed. The United States, with its scientific talent and potential for improving the worldwide information base through more effective use of its satellite and other monitoring capacity, has the responsibility to make that information available throughout the world. The research programs established in S. 1610 would represent a strong and vitally-needed step in the right direction.

There are several opportunities for improving trees and forests in the United States as part of a strategy to mitigate climate change. Included are the improved management and faster growth of existing forests, the conversion of marginal crop and pasture land to new forests, the improvement of urban forests, the use of forest crops as energy crops that would offset the need for fossil fuels, and the expansion of trees and forests for windbreaks, shelterbelts, and streamside corridors. None of these efforts need to await new research, or the onset of critical conditions, before they are started. They can be started immediately, with modest investment, and the environmental improvements that they would trigger would have far-reaching public and private benefits.

The opportunities in urban forests are a good case in point. In a new survey of street tree conditions conducted by the National Urban Forest Council, we have discovered that 52% of the nation's street tree spaces are empty. In other words, the number of street trees in American communities could easily be doubled. Street trees are very important as energy-savers, because they can shade pavement and concrete that would otherwise add significantly to the urban "heat island" effect. But street trees make up only about one-tenth of the tree population in the average community, so in addition to doubling their numbers, we need to take advantage of all the opportunities that exist around homes and businesses. That is a task for citizens, and it is estimated that there are at least 100 million spots where trees could be planted to save energy through reducing air conditioning needs. Planting those trees on private lands is a job to which Global ReLeaf has challenged the American people.

Title II, Subtitle C, of S. 1610 authorizes an urban forestry energy conservation program that would provide educational and technical assistance efforts to encourage the planting and maintenance of energy-saving trees in urban areas. In addition, it would create a new tree planting program supported through competitive grants to local units of government or approved non-profit organizations, and promotes more research on the costs and benefits of urban trees for energy conservation. We strongly support this approach, because it will clearly supplement the existing urban forestry programs that today struggle for research, planning, and implementation funding. We are particularly grateful for the recognition in the legislation that non-profit organizations have a role to play. Our research indicates that virtually every successful community program is supplemented by a strong citizen's support group, and that private contributions to most public programs far outweigh the tax dollars used. With only small incentives such as proposed in S. 1610, we believe the contributions of private organizations can be dramatically increased.

We can improve the growth rate of existing forests in our efforts to mitigate the greenhouse effect. Estimates prepared by the Forest Service indicate that there are opportunties to improve forest growth on over 70 million acres of non-industrial private forests. The realization of these new opportunities will, however, take new efforts in research and technical assistance in order for forest owners to recognize and take advantage of the available opportunities. The Forest Service mandate to provide this information would be strengthened and focused by Title II, Subtitle B of S. 1610.

We also have the opportunity to convert more of our nation's marginal crop and pasture lands to forests. Subtitle F of Title II would make several useful changes in the Conservation Reserve program that would greatly aid in achieving this goal.

On the international scene, it is critical that the United States increase its support and active participation in international efforts such as the Tropical Forestry Action Plan developed by the Food and Agricultural Organization. Subtitle A of Title II would expand the Forest Service's mandate in international forestry activities, increase training programs and outreach activities, and promote assistance to foreign governments and institutions. We are particularly pleased by the concept of reaching out with cooperative, supportive programs to those countries that have the most difficult forest management problems.

Thus, we feel that S. 1610 represents an excellent attempt to encourage Americans to take advantage of the many opportunities that exist for improving trees and forests as one way of mitigating the buildup of greenhouse gasses.

Equally important, in our view, are the research programs aimed at helping us understand the management and policy opportunities available to forest managers in the event that climate change begins to occur as some scientists have predicted. It is not at all certain that we know how forest ecosystems will respond to these changes, and how managers will need to react in order to keep forests healthy and productive. Clearly, we need to have a wide array of management options for forest managers to select among. We need to know more about species adaptation, about varieties that might be planted to recognize shifts in climate, and about the rate at which we should plan to make climate-driven adjustments in our forest management strategies. A forester who plans a new forest is making a gamble on 3 to 10 decades of climatic conditions, and if that future holds new risks, those risks need to be understood and factored into planning as much as possible.

Finally, lets take the doubter's view and make the argument that climate trends are not yet proven, and might not occur as predicted. Would the forest improvements proposed by S. 1610 be in vain? We think not.

Take the urban forest situation, for example. We don't need global warming to have a heat crisis in America's cities. Most cities now have an urban "heat island" effect that makes the densely developed areas some 3 - 8 degrees warmer than the surrounding region. Each degree Fahrenheit in that heat island imposes a two percent energy penalty on the city's residents. In Washington, D.C., for example, we have a 4-5 degree heat island, and it has been rising about one degree a decade. Each degree of that heat island costs D.C. residents $10,000 an hour on a hot summer afternoon. That's $40,000 an hour -- money coming out of people's pockets. We probably can't reduce all that heat effect, but research indicates we could get a degree or two fairly easily with improved urban forest conditions and a program to paint dark surfaces light-colored where feasible.

That means we could save people real money -- right now -- with low-tech, low-cost improvements. Increasing the urban forests in America's communities can make life more healthy and pleasant for people, as well as save money and energy. It makes sense for national policy to promote those kinds of actions, whether or not the global warming trend occurs.

In the rural forests, taking advantage of economically-profitable forest improvement opportunities, replacing marginal, eroding crop and pasture lands with new forests, and helping tropical countries reverse current trends of forest destruction can only have positive environmental and economic impacts. The improvements in water quality, water supply, wildlife habitat, air quality, and biodiversity that will result can pay back our investment manyfold.

Mr. Chairman, we believe that climate change is a real, significant threat. We believe the climatologists that are trying to understand these unprecedented changes are sincere in their attempts to construct useful models and interpret the results as well as possible. So we think that the research and action programs outlined in S. 1610 constitute a constructive, positive early response that can begin to develop a firm basis for future actions that might be needed. But we also believe that the improvements in forestry programs that are proposed in S. 1610 are warranted in their own right, for many environmental and economic reasons. In other words, they will be worth many times their cost no matter what the climate future holds.

Most important, perhaps, is the fact that the policy of the United States will recognize that we have both the opportunity and responsibility to take positive action to improve the environment. If people and their actions have damaged the world's ecosystems to the point where global climatic systems have been altered, we must look to people and their actions to solve the problems that have been created. We must replace deforestation with forest expansion, stunted forests with healthy forests, and polluted conditions with healthier environments. Much of that work must be done in other countries, but the United States can and should provide the leadership in that worldwide effort.

It is time, Mr. Chairman, that we recognize that our security as a nation, and our future as a global human society rests on our ability to live in peace and harmony with the natural environment that supports us. The evidence that we have abused natural conditions beyond their tolerance grows daily, and it is now widely recognized, around the world, that it is time for a historic effort to restore and rebuild the natural world. We are convinced that the American people recognize this fact, and are more than willing to devote time, energy and money to a new and accelerated national conservation effort. The public reaction to our Global ReLeaf campaign has demonstrated this beyond doubt. It is time for America's leadership to catch up with its people on this issue. S. 1610 represents an excellent beginning. We urge this Committee to hasten its consideration and passage into law.

The **CHAIRMAN**. Thank you very much, Mr. Sampson.

Mr. Greenwalt, we will take your testimony and then we will go to questions.

STATEMENT OF LYNN A. GREENWALT, VICE PRESIDENT, INTERNATIONAL AFFAIRS, NATIONAL WILDLIFE FOUNDATION, WASHINGTON, DC

Mr. **GREENWALT**. Certainly, sir. My name is Lynn Greenwalt, and I'm a vice president of the National Wildlife Federation. Considering the interest of time, I will make some observations on the assumption that my testimony will appear in the record.

INTRODUCTION

I agree completely with what my colleague, Neil Sampson, has said about the technical aspects of trees and their worth and their value.

The membership of my organization, which numbers at present about 6 million people, has a concern about global warming. They are not technicians, they are not technically inclined, but they are concerned because change is evident. And it is clear that legislation of this kind is designed to begin to explore the nature of those changes and to do something about it. We cannot speak too highly, we cannot be too enthusiastic about a move to establish some purposeful research to develop a blueprint, as it were, for how this Nation may cope with what may be a very troublesome change in the world around us.

THE GLOBAL DIMENSION OF THE GLOBAL WARMING CONCERN

I would like, however, to say some things about the global dimension of the global warming concern. As has been suggested, it is clear this is not a simple problem or one limited to the Northern Hemisphere or to the United States or to urban living at all. It is something that is likely to affect, indeed, in a most profound sort of way, people all around the world. For that reason, it's important, I believe, to look very carefully and to give great support to the idea of research and assistance as may be offered by the U.S. Forest Service or anybody else, to other nations, in the effort to help resolve this problem.

We have seen through the dramatic kinds of pictures and commentary about the Amazon Basin and the tropical rain forests the way all of this seems to be woven together, in a way that's inextricable. There are also a great many people at stake, as we all know, people who are less able than we are, perhaps, to plant trees or to do other things that are likely to ameliorate the problem. But there is a whole component of the global society that is going to be victimized by the events of global warming, and I think we must keep that in mind.

THIS LEGISLATION CANNOT SOLVE THE PROBLEM, BUT IT IS A MAJOR STEP IN THAT DIRECTION

The attack on this problem, as has been suggested, is likely to be one thing at a time, and that's appropriate. This legislation cannot solve the problem, but it is a major step in that direction. It is, I think, important to keep in mind that there are many other things going on in the world that have relevance to global warming, and which are related in some ways to this legislation and which can be revealed by the research dimension of this legislation. For that reason, the National Wildlife Federation and its membership is prepared to support it.

ONE FINAL OBSERVATION

I would make one final observation. It will be tempting for us often to suggest to other people how they should behave in terms of managing their resources, or deal with their opportunities to benefit themselves. At the same time, we must look carefully at the way we treat our own resources, and we are not entirely without some reason to be ashamed of the way we have managed our own natural resources. I find it somewhat disconcerting that we can suggest that people abroad not sell raw logs when we ourselves do. We manage our forests in a given way and yet criticize others who do exactly the same thing. It's not easy to convince someone whose living standard is substantially below ours to do not as we do but as we say.

Finally, Mr. Chairman, it's a pleasure to be here, and it's a particular pleasure to return to support legislation of this kind because I think it is a step very much in the right direction.

[The prepared statement of Mr. Greenwalt follows:]

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STATEMENT OF LYNN A. GREENWALT, VICE PRESIDENT, INTERNATIONAL AFFAIRS, NATIONAL WILDLIFE FEDERATION

Thank you, Mr. Chairman. I appreciate the opportunity to testify before the Senate Committee on Agriculture, Nutrition and Forestry concerning S. 1610, "The Global Climate Change Prevention Act of 1989" today (November 9, 1989).

The National Wildlife Federation's 5.8 million members and supporters are concerned about the matter of global warming. This reflects the feeling of the public at large, I believe, and underscores the importance of the issue.

We are all aware of the rapid accumulation of evidence of the vast changes in global climactic conditions that Man has induced on this planet. Some employ cataclysmic terms to describe this phenomenon, others use less dramatic language but are nonetheless convinced of the inevitability of what we have wrought. To date, only a few people in the current Administration continue to question the reality of what may be the most important ecological challenge that this planet has yet faced.

Despite all of the attention focussed on the phenomenon of global climactic change, there is little research on the impact such a change will have on agricultural and forestry systems here in the United States or abroad. S. 1610 seeks to expand our knowledge of how global climate change will affect agricultural and forestry resources in the U.S., and how forest loss and agricultural production worldwide contributes to the global warming problem. The bill also calls for research to help determine how agricultural and forestry production can be modified to ameliorate global climate change.

We commend Senator Leahy and the Committee for introducing legislation to help fill these important gaps in our knowledge. The bill ties this research to follow-on activities and does not give the impression, as is given elsewhere, that further research should delay a response to this problem. On the contrary, while the elements of this bill are timely and to the point, there remains a need to take actions now to begin to reverse the global warming trend. This is one issue the active addressing of which cannot wait.

This testimony will point out the areas of the bill having our strongest support, and suggest ways that other parts of the bill might be strengthened.

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The creation of an Office of Global Climate Change, called for in Section 101 of the bill, will help to coordinate activities within the Department, and will have the added and important dimension of coordinating activities with other agencies of the government as well. This inter-agency coordination is critical, particularly with respect to the issue of global warming, because of the array of U.S. governmental agencies that are going to have to be involved in the setting of policy, and in policy implementation.

Other agencies to be dealt with by the Department of Agriculture include the Environmental Protection Agency, the State Department, the Agency for International Development within the State Department, the Commerce Department's National Oceanographic and Atmospheric Administration, and several others. The Office of Global Climate Change should be the lead organization for assisting the Department of Agriculture in working with these other federal agencies.

In addition to the general coordinating function of the Office of Global Climate Change, S. 1610 assigns responsibility to this office for completing a study on the implications of global climate change for agriculture and forestry production here in the United States. This important research is necessary now.

One way this approach can be strengthened would be to include the requirement for an assessment of the environmental impacts associated with the changes in agricultural and forestry production that will most likely occur as a result of global climate change. More specifically, the study should look at the new crops we would expect to see grown in the United States as a result of climate change, and identify the environmental issues posed by the production of these new crops and tree species.

In general, the legislation outlines a very sound research regime by considering the wide variety of implications that global climate change will have for soil and water resources, river transportation and rural employment, pest management, wildfires and the like. Other sections of the bill deal with research designed to ameliorate climate change, and we are supportive of the research called for in both these areas.

It is imperative for us to have a definitive sense of the contribution that current U.S. agricultural and forestry production systems make to the problem of global climate change. The legislation is commendable for including both agriculture and livestock production in the research specified, as well as for consideration of the impact of forest production on global climate change. There is also logic to focussing the research on rice, which is the world's major food crop, and the irrigation of which contributes 20% of the world's methane emissions.

I add a note of caution, however, with respect to the sections of the bill that deal with crop breeding, and the possible genetic "engineering" of microbes that might aid in the reduction of methane emissions.

To begin, the mitigation measures contemplated by the bill, however, are too narrow in scope. They focus almost entirely on genetic adaptation of crops to new climatic conditions. While new cultivars with tolerance to heat or drought will undoubtably be useful in responding to a changing climate, genetics is not the only option. During the severe drought of 1987 and 1988, for example, it was observed that farms in the Midwest using sustainable agricultural practices survived the hot, dry summers better than their neighbors who were employing chemical intensive practices. Some research funds should be designated to exploring the relationship between agricultural practices and productivity under adverse weather conditions.

In the area of genetic resources, we support the provisions in the bill calling for evaluation of current genetic resources. Some of the adapted cultivars we need might already have been developed by farmers somewhere around the world. Programs aimed at preparing us for the eventuality of global warming ought to support efforts to preserve the rich resource of diverse, locally-adapted cultivars currently being lost as third world farmers switch to export crops.

Section 109(b)(iii) should be dropped from the possible methods of achieving reductions in methane emissions. As written, the research approach does not make any sense.

The kind of research meant by "engineering microbes through such activities as genetic engineering of rumen acetogens and engineering better degradation of feed fibres" is not at all clear. To begin, a cow's stomach is a complicated system;

genetically manipulating individual organisms in the system is a roundabout, and not particularly promising, approach to the problem in any case. Second, not all of the available techniques for genetic manipulations would fall under the rubric of genetic engineering called for in the legislation, and there is no reason to suppose that the techniques that do qualify as engineering have an advantage over those that do not.

The bill should direct scarce funds to research approaches that are better understood.

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The next section of the legislation begins with a discussion of the impact of deforestation, in temperate and tropical forests, on global climate change. Again, the legislation does a good job of outlining a fairly complete research agenda dealing with the emissions of methane, nitrous oxide, and hydrocarbons from these forests. The legislation correctly notes that the actual contribution of tropical forests to methane and nitrous oxide production is unknown and the research called for by S. 1610 will provide a clearer picture of the relative contributions made by temperate and tropical forests to global climate change.

In the long term, who controls the process and results of research is often as important as the research itself. Another excellent provision of this bill is its call for a Technical Advisory Committee comprised of representatives from universities, professional societies, governmental laboratories, and other non-governmental groups. It might be appropriate to add report language ensuring the involvement of a wide variety of non-governmental groups, since the bill as currently written leaves it to the Secretary's discretion to choose the Advisory Committee members.

To return to the question of tropical forestry, it is certain that forest loss in the developing countries of the world does make a significant contribution to the emission of greenhouse gases, even if the exact amount of damage caused by deforestation is hotly debated. Furthermore, there are a number of other very important reasons why we should be concerned about the loss of tropical forests, including the impact of forest loss on the people living in these areas and the loss of biological diversity.

Section 201 of the bill, titled, the "International Forestry Cooperation Act of 1989," suggests ways in which the U.S. Forest

Service can promote sound management and conservation of forests and related natural resources in tropical countries. The legislation seeks to guide Forest Service activities in this area by describing in some detail what the focus of its activities should be.

These legislative guidelines are necessary to assure that the Forest Service promotes a sustainable use of forest and other natural resources.

One question that needs to be addressed is how the Forest Service, with relatively little experience in managing tropical forests, can work best to assist developing countries that have tropical forest resources. This is a valid concern, and in the limited experience that the Forest Service does have with tropical forests, some serious mistakes have been made. This is true in the Caribbean National Forest, for which a previous Forest Service Management Plan supported an unsustainable use of the Forest's resources.

Fortunately, a new management plan more in keeping with the objectives of this bill for sustainable management of forest resources has now been adopted. Nevertheless, great care should be given to how the Forest Service develops the center for education on tropical forest management, and any facility for the study of endangered tropical wildlife in Puerto Rico.

In keeping with the emphasis on information sharing, rather than top-down management training, the Committee should eliminate the promotion of the Tropical Forestry Action Plan (TFAP) as an "excellent example of global cooperation on tropical forestry." While sponsors are now trying very hard to improve the Plan, it has been beset by a lack of consultation with local people and non-governmental groups in the developing countries.

When we speak of global cooperation, we must never fail to include as a first priority those people who dwell in tropical forests and, in the same vein, non-governmental organizations in the developing countries. Success cannot be obtained unless these groups are included in every step of the process of deciding how their forest resources should be used. One way to insert this approach into S. 1610 would be to require the Forest Service to conduct a public meeting with representatives from developing country governments, and representatives from non-governmental organizations in these countries for the purpose of identifying an agenda for Forest Service activities. Developing countries are legitimately interested in helping frame their own destinies, and are prepared to cooperate as fully as possible so long as they are a part of the planning and decision processes.

A word about the Urban Forestry Energy Conservation Program. Some of our colleagues in the conservation community have developed a program of this kind, called "Global ReLeaf." We believe programs like this can be helpful and represent an important way to get grassroots involvement in the overall issue. However, these are not solutions to the problem of global warming, and are not advanced as such, though some may come to believe they are efforts sufficient unto the moment.

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In conclusion, Mr. Chairman, this legislation will close some important gaps in our knowledge concerning the impact of global climate change on agricultural production and forestry resources here in the United States. The legislation is also important because it addresses the contributions that current agricultural production and forest use, in the United States and overseas, make to the problem of global climate change.

These are worthy goals. The National Wildlife Federation is concerned about the problem of global warming and regard it -- and its cohort of related environmental consequences -- as the most critical environmental concern the inhabitants of this planet will ever face. We support the principles of this legislation, have offered suggestions we believe would improve it, and are prepared to continue to work with this Committee in whatever ways may be most helpful.

I would like to make one final comment, Mr. Chairman, and that has to do with the impression that problems with the mismanagement of forest resources is confined to the developing countries. It is clear to us this is not the case. Though your legislation does not address this issue, it is important for all of us to bear in mind that the management of our own forest resources is a serious problem.

In fact, there is often an element of hypocrisy involved in our calls for better management of tropical forests. For example, due to domestic and international pressure, President Sarney of Brazil announced last April 6, 1989 a ban on the export of raw timber from that country. Yet, we see in the Pacific Northwest our sale of old-growth forest timber to Japan, the same destination to which much of the tropical hardwoods in Brazil were consigned.

There are a number of reasons to promote the sustainable use of forest resources, not the least of which are aesthetic reasons, and the preservation of biological diversity especially in the tropical countries. Your legislation takes note of another reason, and that is the contribution that forest loss makes to the problem of global climate change. While this is probably a more serious problem in tropical forests than in our temperate forests, it behooves us to approach this in a manner which recognizes our own need to change. I hope some of this fundamental philosophy can be reflected in report language as the legislation moves forward.

The CHAIRMAN. Thank you very much. It is fascinating the amount of support we've had for this from an awful lot of people. The interesting thing is those who have not—you deal with this issue professionally all the time, both of you. But I have heard from so many people who do not deal with it professionally, reforestation and other issues, people who show a great deal of enthusiasm and say they want to do whatever they can. Somebody just tell them what to do. I'm just glancing at the two pamphlets, Mr. Sampson, in that regard.

I think there is certainly a willingness to take action. There's just a desire on everybody's part to know the best way to do it.

I yield to Senator Lugar.

Senator LUGAR. Thank you, Mr. Chairman. I join you in thanking Mr. Sampson and Mr. Greenwalt and the members they represent for their support of our efforts.

Mr. Sampson, I just wanted to check on a comment that you made in your introductory remarks. You mentioned 74 degrees and 92 degrees as the parameters for something. Would you run back through your statement again as to what happens almost inevitably at 92 degrees or above or almost inevitably at 74 degrees and below?

Mr. SAMPSON. Cities tend to break the ambient air quality standard for ozone and smog, above 92 almost inevitably, and almost never break it below 74.

Senator LUGAR. Any city, any place?

Mr. SAMPSON. Yes. That's basically right. The process is very temperature-driven. If you look at the scattergraph, of pollution results related to temperature, it looks like it goes the same way in virtually all cities and cases.

Senator LUGAR. So if you have a city in the United States where the temperature never got above 74, they would never——

Mr. SAMPSON. You'd have a very little ozone and smog problem, yes, unless you really had a tremendous source. Like I said, it's a scattergraph so it's not perfectly true, but it's very close.

Senator LUGAR. Now, given those parameters, what is the definition or what is the meaning of the heat island that you were talking about?

Mr. SAMPSON. Well, that's basically when the TV news guy comes on and says, "Downtown it's 84 degrees, and out in the suburbs it's 76." The basic difference is how much heat is being trapped by the pavement and the concrete and the stone and how much is being generated by the motors and the cars and the air-conditioning units in the community.

We obviously can't take out all of those, but the more we can shade that community with a tree canopy and the more we can take black surfaces and paint them white, the more we can bring that heat island effect down. This idea comes from a significant amount of energy research that is looking for cost effective, sensible, do-it-now energy-conserving strategies for the United States. This urban heat island, which affects 80 percent of our people, is one of the places to look.

Senator LUGAR. In the Washington area, for example, would the island be represented by the difference between the Dulles temperature reading and the National Airport reading?

Mr. **Sampson**. Pretty much, except that the National Airport reading and the downtown reading are probably a little different as well. We might also say, like a lot of other things in this issue, that temperature record is not a very certain science. They used to take the temperature by sticking the thermometer out the window of the radio station. Only about 25 or 30 years ago did they move official stations to the airports, and then we urbanized around the airports, and then moved some of the airports. So the data history on city temperature trends is not a lot better than some of the other science we have to deal with in this.

Senator **Lugar**. But your testimony was that additional trees might make a difference of a degree or two.

Mr. **Sampson**. That's right. Dayton, Ohio, and other places have demonstrated that that's doable.

Senator **Lugar**. There actually has been research to that effect.

Mr. **Sampson**. Yes.

Senator **Lugar**. I thank you very much.

The **Chairman**. I do not really have any questions. I think that not only do we have to develop the consensus in the way to take some of these steps in our own country, but I would certainly be open to any suggestions about what we do in other countries, wearing another hat of chairman of the Appropriations Subcommittee on Foreign Operations. I well understand that it is a difficult thing sometimes for the United States to come in and say here's the way you should do this. A country that might have a per capita income of $500, $1,000, or whatever, it's like saying in the Sudan and other places you shouldn't cut down those trees. You need to cut erosion in soil, and you're saying that to somebody whose family may die if they don't cut down that tree and have it for fuel and so on.

It is going to require a great deal of effort until alternatives can be shown, but also if we're going to exercise technical leadership, we also need to exercise moral leadership. We have to be able to show that we are taking these steps ourselves.

Mr. **Greenwalt**. Absolutely. That's the point I wanted to make. Everything has to begin with a step, and thus far there seems to have been a reluctance to take that first step.

Senator **Lugar**. Mr. Chairman, if you would yield on that point for a moment. When I visited with people in Brazil in August I found that, indeed, there is concern by many Brazilian legislators about the cutting of the Amazon forest. On the other hand, there has been so little research in Brazil or even worldwide about the impact of those actions. Those legislators, as sophisticated people who are interested in Brazil and the environment, don't condemn persons who are desperate and who are doing things they should not be doing to survive. Instead they are thinking of compensatory measures within their own country, which are substantial, can be substantial, once there is a road map of really what the cures may be. Additionally, I believe there is much greater sensitivity with regard to landowners who ought to know better, leaving aside people that are in poverty and who cut down a tree to warm their house.

Mr. **Sampson**. We have some opportunity to help, though. We have the ability to gather information over those remote areas because of our satellite imagery, and we're not using that. In fact, we're talking about shutting the ERTS satellite off because we can't afford to keep the lights lit. We can help in a way that is not pushy by simply helping them develop a better information and research base. The research capability we have in Hawaii and in Puerto Rico doesn't all apply, obviously, but some of those scientists are some of the best in the world, and their talents can be loaned and their knowledge can be shared.

The CHAIRMAN. Puerto Rico and others.

Mr. SAMPSON. That's right. I would like to say thanks very much for doing what you're doing. We've discovered that people innately react to the notion that we have to begin to be positive about our environment. We have to begin restoring and renewing the Earth. People intuitively recognize that if 5 billion of us are going to live on this Earth, we can't all be users and degraders of the environment. A lot of us must be builders and supporters. People also think that the United States should take real leadership in environmental action. If that means helping folks in the Sudan figure out how to get around their problems with research or some other thing, we really have a responsibility there. I think you're proposing the right way to mobilize responsible U.S. policy and action.

The CHAIRMAN. Thank you.

[Whereupon, at 4:03 p.m., the committee was adjourned, subject to the call of the Chair.]

[Material submitted for inclusion in the record follows:]

II

101ST CONGRESS
1ST SESSION

S. 1610

To develop a program to determine potential impacts of climate change on agriculture and forestry, to provide for the development of policies designed to address issues of potential climate change, with respect both to developing a capacity for agriculture and forestry to adapt to climate change, and to developing innovative ways to ameliorate climate change, and for other purposes.

IN THE SENATE OF THE UNITED STATES

SEPTEMBER 12 (legislative day, SEPTEMBER 6), 1989

Mr. LEAHY (for himself, Mr. LUGAR, Mr. WIRTH, Mr. KASTEN, Mr. DASCHLE, Mr. BOSCHWITZ, Mr. BUMPERS, Mr. GORE, Mr. JEFFORDS, Mr. MATSUNAGA, Mr. CONRAD, Mr. HEINZ, Mr. PELL, Mr. LIEBERMAN, and Mr. HARKIN) introduced the following bill; which was read twice and referred to the Committee on Agriculture, Nutrition, and Forestry

NOVEMBER 20 (legislative day, NOVEMBER 6), 1989
Committee discharged

A BILL

To develop a program to determine potential impacts of climate change on agriculture and forestry, to provide for the development of policies designed to address issues of potential climate change, with respect both to developing a capacity for agriculture and forestry to adapt to climate change, and to developing innovative ways to ameliorate climate change, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Global Climate Change Prevention Act of 1989".

SEC. 2. FINDINGS.

The Congress finds that—

(1) the earth's atmosphere is being altered by the generation of carbon dioxide and other infrared absorptive gases;

(2) these gases are, in large part, linked to population growth and are the byproducts of human activities, including the widespread combustion of fossil fuels, deforestation, and the use of chlorofluorocarbons;

(3) agricultural production and forest practices may contribute to global climate change, and that such contributions must be evaluated in light of the enormous productivity of modern agriculture and the importance of maintaining a viable agricultural production base;

(4) there is reasonable scientific concern that the atmospheric "greenhouse effect" is likely to cause a general global warming trend that may cause significant disruption of temperature and precipitation patterns worldwide;

(5) the global warming trend may cause serious economic and environmental dislocation within American agriculture and forestry, including diminished ca-

pacities to grow certain major crops and timber species in the geographic regions in which they are currently produced;

(6) such impacts could threaten the national economy and world food security; and

(7) expanded application of sustainable agricultural and forestry practices and energy conservation may ameliorate the greenhouse effect.

TITLE I—AGRICULTURE AND GLOBAL CLIMATE CHANGE

Subtitle A—Office of Climate Change

SEC. 101. OFFICE OF CLIMATE CHANGE.

(a) ESTABLISHMENT OF OFFICE OF CLIMATE CHANGE.—For the purpose of having within the Department of Agriculture a focal point for coordinating all issues of climate change there is hereby established in the office of the Secretary of Agriculture the Office of Climate Change (hereinafter referred to as the "Office"). The Director of the Office shall be appointed by and report to the Secretary.

(b) DUTIES.—The Office of Climate Change shall serve as the lead organization within the Department of Agriculture for coordinating policy analysis, long range planning, research, and response strategies relating to climate change issues. The Office shall insure that a concern for the potential for climate change is fully integrated into the research, planning, and decision-making processes of the Department. The Office shall provide liaison with other United States Government agencies dealing with issues of climate change and shall insure that the impacts on agriculture and forestry are fully understood and addressed in interagency councils, including with respect to broader issues relating to such matters as energy which affect the impact of climate change upon the Nation's farms and forests. The Office shall keep the Secretary fully apprised of scientific developments and policy issues relating to climate change and agriculture and forestry, and it shall advise the Secretary with respect to alternative courses of action.

(c) SPECIFIC RESPONSIBILITIES.—The Office of Climate Change shall be responsible for—

(1) coordinating the response of the Department of Agriculture to the requirement for a climate change study contained in section 102 of this Act;

(2) providing, through the Cooperative State Research Service, competitive grants for research in atmospheric sciences and climatology as they relate to the potential impact of climate change on agriculture and forestry;

(3) providing, through the Cooperative State Research Service, competitive grants for research on the

potential for agriculture and forestry to mitigate the buildup of atmospheric carbon dioxide and methane;

(4) coordinating United States Department of Agriculture participation in interagency climate-related activities;

(5) coordinating with the climate research activities of the National Academy of Sciences and climate-related activities of other private, academic, State, and local groups;

(6) representing the Department on the Climate Program Policy Board as established by the National Climate Program Act (15 U.S.C. 2901 et seq.) and for coordinating activities of the Department of Agriculture in response to requirements of that Act;

(7) representing the Department of Agriculture on the Intergovernmental Panel on Climate Change; and

(8) reviewing and making recommendations with respect to all United States Department of Agriculture budget items relating to climate change issues, including specifically the research budget submitted to the Committee on Earth Sciences, and the United States Department of Agriculture submission to the Office of Management and Budget's integrated multiagency request under the National Climate Program.

SEC. 102. UNITED STATES DEPARTMENT OF AGRICULTURE STUDY ON AGRICULTURE AND FORESTRY IMPLICATIONS OF GLOBAL CLIMATE CHANGE.

(a) STUDY.—The Secretary of Agriculture, in consultation with other appropriate government departments and agencies, shall conduct a study on the implications of global climate change for agriculture and forestry.

(b) PURPOSE.—The study shall assess the potential effects of global climate change on United States agriculture and forestry and on global food production and trade, including implications for—

(1) soil and water resources;

(2) river transportation and rural employment;

(3) management of destructive agents such as pests, plant diseases, and wildfires;

(4) geographic ranges of crops and forest species;

(5) adequacy of available crop and forest genetic resources;

(6) irrigation and tillage practices;

(7) long range world food and fiber supplies and prices, including global nutritional needs;

(8) United States exports and international trade; and

(9) United States agricultural and forestry policies and programs.

(c) REPORT.—Within 24 months following the date of the enactment of this Act, the Secretary of Agriculture shall report to Congress on the results and findings of the study prepared pursuant to this section.

Subtitle B—Research on Global Warming, Forests, and Agriculture

SEC. 106. SHORT TITLE.

This subtitle may be cited as the "Domestic Research on Global Warming, Forests, and Agriculture Act of 1989".

SEC. 107. FINDINGS.

The Congress finds that—

(1) the Earth's atmosphere is changing due to increasing concentrations of anthropogenic and biogenic pollutants including methane (CH4), carbon dioxide (CO2), nitrous oxide (N2O), non-methane hydrocarbons (NMHC), and tropospheric ozone (O3);

(2) temperature increase and other climatological phenomena are likely to result from the greenhouse gas emissions to the atmosphere which have already occurred to date, even if stringent efforts are made to limit emissions;

(3) studies have shown that global warming is likely to cause changes in the climatology and hydrology of major crop growing areas; these changes could lead to climatologic regimes outside of recent experi-

ence and may potentially interfere with the world supply of food and the agricultural productive capacity of many countries;

(4) current scientific studies indicate that changes in current precipitation patterns and sea surface temperatures may lead to increases in the severity and frequency of storms and hurricanes;

(5) understanding the potential risks that global warming is presenting to agriculture and forestry is important to formulating programs to limit emissions; and

(6) forests and agricultural systems may offer the potential for limitation of emissions through changes in planting, harvesting, fertilizing, and other practices.

SEC. 103. PURPOSES.

(a) The primary purpose of this subtitle is to identify research priorities and direct research for examining the effects of global warming on forests and agricultural productivity and to determine and demonstrate possible changes in forest management and agricultural practices which could reduce emissions of greenhouse gases, with due regard for the maintenance of agricultural productivity and incomes.

(b) In support of the purpose described in subsection (a), the specific purposes of this Act are to direct research to—

(1) assess the impacts of global warming on crops vital to the world and the United States and develop means to mitigate the impacts, if necessary;

(2) assess the emissions of greenhouse gases from forest and agricultural processes, determine means of reducing these emissions where possible, and explore cost effective options for emissions reduction; and

(3) assess potential increases in greenhouse gases and related pollutants from agriculture and forests in response to global warming.

SEC. 109. RESEARCH STUDIES.

(a) CROPS.—

(1) FINDINGS.—The Congress finds that—

(A) rice is the major world crop, providing 70 percent of caloric intake for 2.8 billion people; several studies have shown that temperature rise can adversely affect rice during periods of reproduction and ripening; the impacts on rice of combined increased temperatures and carbon dioxide are unknown;

(B) the potential effects of temperature increases on crops grown widely in the United States such as corn, sorghum, wheat, soybeans, and millet are unknown; existing studies show maize, sorghum, wheat, millet, and soybeans are adversely affected by high temperatures during phases of early growth, flowering, and ripening; studies also show that the viability and vigor of the next generation of seed are adversely affected by high temperatures during development for millet and soybeans;

(C) methane is an important greenhouse gas with many times the warming per equivalent change in atmospheric concentration as carbon dioxide; methane has a relatively short atmospheric lifetime of 7 years so the effect of cutbacks in emissions could be realized within the next decade; recent studies indicate that a cutback of 10 to 20 percent in methane emissions would stabilize concentrations at current levels;

(D) current estimates suggest that irrigated rice production contributes 20 percent of the world's methane emissions; however, these estimates are based on limited studies and data;

(E) methane emissions from irrigated rice cultivation may be affected by fertilization practices, management practices, and soil temperatures; methods for reducing methane emissions from irrigated rice production have not been examined, but may be possible; and

(F) nitrous oxide concentrations have increased by 5 to 10 percent since preindustrial times; each nitrous oxide molecule has over 200 times the impact on climate change as a carbon dioxide molecule; emissions from nitrogen intensive crops may contribute to this rise; however, there is insufficient information to estimate this contribution or to then formulate plans to reduce these nitrous oxide emissions if substantial.

(2) STUDIES ON RICE YIELDS.—

(A) The Secretary of Agriculture shall conduct a study on the effects of global warming on rice production which shall at a minimum address—

(i) the impacts of a range of possible simultaneous increases in temperature and carbon dioxide on the yields of the most temperature tolerant and most economically important species of rice.

If the results of the study conducted under subparagraph (i) warrant, the Secretary shall conduct a study addressing means of mitigating the impacts of global warming on rice which shall—

(ii) identify if tolerance can be bred into sensitive cultivars, within what timeframe and ultimately with what effects on farmers' incomes;

(iii) evaluate the current genetic resources and current breeding programs for rice for their sufficiency for developing new breeds which will be tolerant to anticipated climate changes; and

(iv) assess the potential for breeding rice cultivars which are tolerant to anticipated climate changes and which also have other desirable traits such as tolerance to drought, pests, and salinity.

(B) The Secretary of Agriculture shall provide a report of the results of the study conducted under subparagraph (A) to the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Agriculture of the House of Representatives within 4 years after the enactment of this Act. Interim reports shall be provided yearly.

(C) There are authorized to be appropriated for fiscal year 1990, and each of the next following 3 fiscal years, $2,000,000 to carry out such studies.

(3) STUDIES ON MAJOR UNITED STATES CROPS.—

(A)(i) The Secretary of Agriculture shall conduct experimental studies on the effects of global warming on the production of major United States crops which shall at a minimum address—

(I) the impacts of simultaneous increases in temperature and carbon dioxide on yields of corn, wheat, sorghum, millet, and soybeans;

(II) the impacts of more severe weather events;

(III) the impacts of potential changes in hydrologic regimes on current crop yields;

(IV) the economic and social impacts of widespread and increased drought frequency in the south, midwest, and plains States; and

(V) changes in pest problems due to higher temperatures.

(ii) If the results of the study conducted under subparagraph (i) warrant, the Secretary of Agriculture shall conduct further studies addressing means of mitigating the impacts of global warming on major United States crops which shall at a minimum—

(I) identify if tolerance can be bred into sensitive crops, within what timeframe, and ultimately with what effects on farmers' incomes;

(II) evaluate the current genetic resources and current breeding programs for crops in terms of their sufficiency for developing new breeds which will be tolerant to anticipated climate changes; and

(III) assess the potential for breeding crops which are tolerant to anticipated climate changes and which also have other desirable traits such as tolerance to drought, pests, and salinity.

(B) The Secretary of Agriculture shall provide a report of the results of the study conducted under paragraph (2) to the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Agriculture of the House of Representatives within 6 years after the date of the enactment of this Act. Interim reports shall be provided yearly.

(C) There are authorized to be appropriated for fiscal year 1990, and each of the next following 5 fiscal years, $4,000,000 to carry out such studies.

(4) METHANE EMISSIONS.—

(A) The Secretary of Agriculture shall conduct a study on methane emissions from United States and Asian irrigated rice production which shall at a minimum address—

(i) obtaining detailed and systematic field measurements of emissions of methane from irrigated rice cultivation;

(ii) determining methane emissions from irrigated rice cultivation over complete growing seasons;

(iii) determining the effect of soil temperature and fertilizer rates and types on methane emissions;

(iv) obtaining measurements of other trace gases such as nitrous oxide in irrigated rice cultivation;

(v) evaluating options for reducing methane emissions from rice growing including cultivar selection and management practices; and

(vi) assessing the effects of simultaneously increased temperature and carbon dioxide on methane emissions.

(B) The Secretary shall provide a report of the results of the part of the study conducted under subparagraph (A) and his recommendations for promulgating the results to the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Agriculture of the House of Representatives within 3 years after the date of the enactment of this Act. Interim reports shall be provided yearly.

(C) There are authorized to be appropriated for fiscal year 1990, and each of the next following 2 fiscal years, $1,000,000 to carry out such studies.

(5) EMISSIONS FROM NITROGEN INTENSIVE CROPS.—

(A) The Secretary of Agriculture shall conduct a study on the magnitude and types of emissions from nitrogen intensive crops and on means for reducing emissions which shall at a minimum address—

(i) obtaining field measurements of nitrous oxide from nitrogen intensive growing of such grains as corn, cotton, wheat, legumes, and rice;

(ii) obtaining measurements of nitrous oxide from manure and biomass burning; and

(iii) identifying management techniques appropriate for sustainable or other agricultural practices that can reduce the emissions of nitrous oxide.

(B) The Secretary of Agriculture shall provide a report of the results of the study conducted under subparagraph (A) to the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Agriculture of the House of Representatives within 3 years after the date of the enactment of this Act. Interim reports shall be provided yearly.

(C) There are authorized to be appropriated for fiscal year 1990, and each of the next following 2 fiscal years, $1,000,000 to carry out such studies.

(b) LIVESTOCK.—

(1) FINDINGS.—The Congress finds that—

(A) managed ruminants and other animals are an important source of methane emissions from human activities, accounting for on the order of 15 percent of total annual methane emissions; and

(B) many promising opportunities exist for reducing methane emissions from this source; these efforts may simultaneously contribute to higher animal productivity and increased farmers' incomes which would have significant benefits in addition to the benefit of reducing methane emissions.

(2) METHANE EMISSIONS EVALUATION, USE, AND CONTROL PROGRAM.—

(A) The Methane Emissions Evaluation, Use, and Control Program shall be created in the United States Department of Agriculture. The objectives of this program are to—

(i) evaluate methane emissions from agriculture-related activities in the United States and around the world, particularly the management of ruminants and other animals and the wastes produced by these animals;

(ii) develop data describing the factors influencing rates of emissions from agriculture-related activities and identify opportunities for reducing methane emissions from agricultural activities; and

(iii) demonstrate the effectiveness of alternative methods of reducing methane emissions from agricultural activities under field conditions.

(B) The program shall evaluate the feasibility and costs (including effects on farmers' incomes) of options for achieving reductions in methane emissions from animal management activities, including—

(i) modifying the feeding strategies of United States dairy and beef animals, while maintaining or improving animal productivity and profitability;

(ii) evaluating the use of supplements (i.e., nonprotein nitrogen supplements, such as urea) to animals in developing countries in terms of the types of animals that may benefit, the costs of providing supplements, and the methane reductions achieved;

(iii) assessing the near- and long-term opportunities for reducing methane emissions by engineering microbes through such activities as genetic engineering of rumen acetogens and engineering better degradation of feed fibres;

(iv) evaluating the magnitude of variation of individual animals in terms of methane production and the heritability of the characteristic; and

(v) evaluating current animal waste management practices in terms of methane generation and identifying and evaluating options for recovering or preventing the release or creation of this methane.

The program shall also evaluate options for the beneficial utilization of methane.

(C) The Secretary of Agriculture shall provide a report of the options evaluated in subparagraph (B) to the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Agriculture of the House of Representatives within 18 months following the date of the enactment of this Act. Included in the report shall be recommended studies and demonstration projects that will improve our understanding of opportunities for reducing and using methane emissions from agriculture-related activities. The Secretary shall initiate these studies and demonstration projects within 6 months after submission of the report. First priority shall be given to demonstrating those opportunities for reducing emissions that are anticipated to increase animal productivity in the United States or developing countries or are anticipated to be cost beneficial in their own right.

(D) There is authorized to be appropriated for fiscal year 1990, $5,000,000, and for each of the next following 2 fiscal years, $7,000,000, to carry out such program.

(c) FORESTS.—

(1) FINDINGS.—The Congress finds that—

(A) deforestation activities make a major contribution to carbon dioxide in the atmosphere;

(B) temperate and tropical forests may be adversely affected by climate change;

(C) tropical forests may be major sources of methane and nitrous oxide; however, the actual contribution of tropical forests is unknown;

(D) improved management of forests and increased planting of trees could result in increased utilization of forests as carbon sinks; and

(E) current research and information are inadequate to allow accurate assessment of either risks to forest systems from global warming or opportunities to reduce global concentrations of greenhouse gases using altered management practices.

(2) STUDY.—

(A) The Secretary shall conduct a study on the emissions of methane, nitrous oxide, and hydrocarbons from tropical and temperate forests, how global change may affect emissions, and how the emissions may be reduced through management practices which shall at a minimum address—

(i) obtaining measurements of nitrous oxide, methane, and nonmethane hydrocarbons ("NMHCs") from tropical forests;

(ii) obtaining measurements of NMHCs from temperate forests;

(iii) determining how the NMHC emissions from temperate and tropical forest systems will respond under anticipated climate change;

(iv) identifying management techniques for temperate and tropical forests which could potentially reduce emissions of greenhouse gases; and

(v) determining how the carbon dioxide sink that forests create can be increased by more intensive management, use of new lands, and planting of short rotation trees.

(B) The Secretary of Agriculture shall provide a report of the results of the study conducted under subparagraph (A) to the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Agriculture of the House of Representatives within 3 years after the enactment of this Act. Interim reports shall be provided yearly.

(C) There are authorized to be appropriated for fiscal year 1990, and each of the next following 2 fiscal years, $2,000,000 to carry out such studies.

SEC. 110. COORDINATION.

For all of the activities discussed in this subtitle, the Secretary of Agriculture shall coordinate plans and activities with the Environmental Protection Agency. In particular, the Secretary shall submit to the Environmental Protection Agency a report on options for controlling methane emissions from livestock and rice on a schedule compatible with the Environmental Protection Agency's needs to prepare control plans for all methane sources.

SEC. 111. TECHNICAL ADVISORY COMMITTEE.

(a) Establishment.—The Secretary of Agriculture shall establish a technical advisory committee to advise on the major study areas such as studies on rice, studies of crops vital to the United States, studies of methane emissions from rice, studies of emissions from nitrogen intensive crops, etc., and for the Methane Emissions Evaluation, Use, and Control Program discussed in this subtitle.

(b) Members.—The technical advisory committee shall comprise representatives of universities, professional societies, government laboratories, agricultural, environmental and other organizations as the Secretary, in consultation with the Environmental Protection Agency, deems appropriate based on the Secretary's assessment of the technical and other qualifications required to advise on the different major study areas. Appointments to the technical advisory committee shall be made within 90 days after the date of the enactment of this Act. The technical advisory committee shall have a chairman who shall be elected by the members from among their number.

SEC. 112. DEFINITIONS.

As used in this subtitle, the term "Secretary" means the Secretary of Agriculture.

TITLE II—FORESTRY AND GLOBAL CLIMATE CHANGE

Subtitle A—International Forestry Cooperation

SEC. 201. SHORT TITLE.

This subtitle may be cited as the "International Forestry Cooperation Act of 1989".

SEC. 202. FINDINGS AND PURPOSE.

(a) FINDINGS.—The Congress finds that—

(1) the nations of the world are bound by common interest in achieving sustainable global environmental stability, economic development, scientific discovery, and opportunities for trade;

(2) nations are inextricably dependent upon and linked to each other for resources;

(3) forests in many parts of the world are rapidly declining both in terms of health and extent. In the tropics, an estimated 28 million acres of forests are lost each year and another 9 million acres are seriously degraded. Deforestation in the tropics is a major contributor to global climate change, threatens the very ability of land to sustain life and reduces biological diversity. In nonforested areas of the tropics, pastoral and community trees are rapidly disappearing. In temperate regions where deforestation has been stabilized, indus-

trial pollution, insects and diseases threaten productivity;

(4) forestry and natural resource programs in the United States benefit substantially from international advances in science and technology, a better balance in wood products trade, greater utilization of wood products, and an improved global environment;

(5) tropical forests and woodlands are essential to the economic and social well-being of people in developing countries;

(6) global forestry and natural resource problems require global solutions which can only be achieved through concerted international cooperation. An excellent example of global cooperation on tropical forestry is the Tropical Forestry Action Plan (TFAP), which is coordinated by the Food and Agriculture Organization (FAO);

(7) the United States Department of Agriculture, through the Forest Service and other cooperating agencies, has expertise and experience that could contribute significantly to the transfer of forestry related knowledge and technology between the United States and foreign countries. In particular, Forest Service technology transfer, research and training experience could be brought to bear on problems facing tropical

forests and tropical forest dwellers, and to demonstrate and teach multiple-use tropical forest management;

(8) the United States Department of Agriculture Forest Service has over 70 years experience managing the Caribbean National Forest/Luquillo Experimental Forest in Puerto Rico, and over 50 years of experience conducting tropical forestry research at the facility. In addition, the Forest Service conducts tropical forestry research and technology transfer programs in Hawaii, the Western Pacific, and at the Forest Products Laboratory in Wisconsin; and

(9) the Caribbean National Forest/Luquillo Experimental Forest in Puerto Rico, is the only tropical forest that is managed by the United States Department of Agriculture Forest Service. This forest has been designated a Biosphere Reserve by the UNESCO Man and Biosphere Program.

(b) PURPOSE.—The purpose of this title is to encourage cooperation with other countries as they seek to achieve sustainable economic development through sound natural resource management that meets human needs while protecting environmental quality, and to that end, encourage the participation of the United States Department of Agriculture Forest Service in promoting sound management and conservation of forests and related natural resources in other countries.

SEC. 203. FORESTRY AND RELATED NATURAL RESOURCE ASSISTANCE.

(a) COUNTRY FOCUS.—

(1) The Congress finds that remedial actions with respect to forestry policy and resource conservation and development undertaken by a relatively few key industrializing, middle income and low-income developing countries (hereafter in this title "key countries") could have a substantial impact on emissions of greenhouse gases related to global warming.

(2) In order to achieve the maximum impact from activities undertaken under the authority of this title, the Secretary shall focus such activities on the key countries referred to above.

(b) AUTHORITY FOR INTERNATIONAL FORESTRY ACTIVITIES.—In support of forestry and related natural resource activities outside the United States and its territories and possessions, the Secretary is authorized, when requested to do so by the Administrator of the Agency for International Development, to—

(1) provide assistance that promotes sustainable development and global environmental stability, including but not limited to: conservation and sustainable management of forest land; forest plantation technology and tree improvement; rehabilitation of cutover lands, eroded watersheds, and areas damaged by wildfires or

other natural disasters; prevention and control of insects, diseases, and other damaging agents; preparedness planning, training, and operational assistance to combat natural disasters; more complete utilization of forest products leading to resource conservation; range protection and enhancement; and wildlife and fisheries habitat protection and improvement;

(2) share technical, managerial, extension, and administrative skills related to public and private natural resource administration;

(3) provide education and training opportunities in order to promote the transfer and utilization of scientific information and technologies;

(4) engage in scientific exchange and cooperative research with foreign governmental, educational, technical and research institutions; and

(5) cooperate with United States and international organizations that further international programs for the management and protection of forests, rangelands, wildlife and fisheries habitat, and related natural resource activities.

SEC. 204. TROPICAL DEFORESTATION ASSESSMENT AND ASSISTANCE.

In support of the Tropical Forestry Action Plan and to specifically address tropical deforestation and degradation, the Secretary is authorized to—

(1) support and actively participate in global and regional meetings that seek to refine the Tropical Forestry Action Plan and promote coordination among all agencies involved in its implementation;

(2) together with the United States Agency for International Development (AID), and other United States Government agencies, provide technical assistance to tropical countries for the formulation of national forestry sector development strategies;

(3) cooperate with tropical countries on research, training, and technical programs aimed at implementing national forestry sector development strategies;

(4) provide staff to the Food and Agriculture Organization through the Associate Professional Officer Program or other mechanisms on either long- or short-term assignments to assist with assessing the status of tropical forests and other aspects of tropical forestry and natural resources development. Assignments may be at the Food and Agriculture Organization headquarters or in tropical countries;

(5) share with the Food and Agriculture Organization nonsensitive technologies and satellite imagery relevant to assessing the status of tropical forests; and

(6) provide financial assistance to the Food and Agriculture Organization for the purposes of assessing the status of tropical forests, for implementing and coordinating the Tropical Forestry Action Plan, and for related tropical forestry development activities.

SEC. 205. TRAINING FOR TROPICAL FOREST MANAGEMENT AND CONSERVATION.

In support of tropical forestry training activities both within and outside the United States and its territories and possessions, the Secretary is authorized to—

(1) develop partnerships with tropical forestry management, research or training institutions to promote the exchange of technical information and personnel on all aspects of natural resource conservation and forest land management. Special attention should be given to assisting tropical countries with outreach activities which promote "grass roots" reforestation, multiple-use forest management, and land rehabilitation activities;

(2) develop and maintain close cooperation with universities and technical schools both in the United States and in tropical countries to facilitate the educa-

tion and training of students and professionals on all aspects of research and management of tropical forest lands;

(3) manage the Caribbean National Forest/Luquillo Experimental Forest, as a model of quality tropical forest management, as a site for research on tropical forestry and natural resources, and as a center for demonstration, training, and outreach on tropical forest and natural resources research and management;

(4) utilize the facilities and resources of the Forest Service, including the Institute of Tropical Forestry, the Institute of Pacific Islands Forestry, and the Forest Products Laboratory to carry out research, technology transfer, training, information exchange, and demonstrations on management of tropical forests and related resources; and

(5) in cooperation with the United States Agency for International Development (AID), work with tropical country governments, land managers, and industry to cooperatively encourage local and village level conservation, reforestation, training, and education for sustainable tropical forestry management.

SEC. 206. INSTITUTE OF TROPICAL FORESTRY.

(a) The Secretary shall expand the capabilities of and construct additional facilities at the Caribbean National

Forest and Institute of Tropical Forestry in Puerto Rico, as the Secretary deems necessary and as funds are appropriated for such purpose, to support the purpose of this title.

(b) Within 1 year following the date of enactment of this title, the Secretary shall prepare and submit to the Committee on Agriculture, Nutrition, and Forestry of the Senate and to the Committee on Agriculture of the House of Representatives a plan for the expansion and construction of such additional facilities. Such a plan shall include, but not be limited to, provisions for—

(1) a major center for education, interpretation, and appreciation of the benefits and methods of the wise management of tropical forests;

(2) facilities for housing and classroom instruction near the Caribbean National Forest/Luquillo Experimental Forest; and

(3) facilities for the study of and recovery of endangered tropical wildlife, fish and plant species.

SEC. 207. ADMINISTRATIVE PROVISIONS.

(a) COORDINATION ACTIVITIES.—The Secretary shall coordinate all activities outside the United States under this title with other Federal officials, departments, agencies, and international organizations, as the President may direct.

(b) ASSISTANCE.—As the Secretary deems appropriate in furtherance of this title, the Secretary may provide assistance including, but not limited to, technical and financial assistance, equipment, and facilities without reimbursement.

SEC. 208. APPROPRIATIONS AUTHORIZATION.

There are authorized to be appropriated such funds as are necessary to carry out the provisions of this title.

SEC. 209. CONFORMING AMENDMENTS.

(a) AMENDMENTS.—The Forest and Rangeland Renewable Resources Research Act of 1978 (16 U.S.C. 1600 et seq.) is amended as follows:

(1) in section 2, designate the existing text of subsection (a) as paragraph (1) and add at the end the following new paragraph:

"(2) The Congress further finds that the forest and rangeland renewable resources of the world are threatened by deforestation due to conversion to agriculture of lands better suited to other uses, over-grazing, over-harvesting, and other causes which pose a direct adverse threat to people, the global environment, and the world economy. It is an additional purpose of this Act to authorize the Secretary to expand research activities to encompass international forestry and natural resource issues on a global scale.";

(2) in section 3(a), delete the period at the end of the first sentence and insert the words "of the United

States and such other countries as the Secretary deems desirable.";

(3) in section 4, insert the word "international, " before the word "Federal" in the first sentence of subsection (c);

(4) in section 6, add the following new subsection:

"(g) In conducting activities authorized by this Act outside the United States, the Secretary shall coordinate with other Federal officials, departments, agencies, or international organizations, as the President may direct.".

(b) AMENDMENTS.—The Cooperative Forestry Assistance Act of 1978 (92 Stat. 365) is amended as follows:

(1) in section 2(a), delete "and" at the end of paragraph (6), delete the period and insert in lieu thereof "; and" at the end of paragraph (7), and add the following new paragraph at the end thereof:

"(8) the same forest resource supply, protection and management issues which exist in the United States are also present on an international scale, and the forest and rangeland renewable resources of the world are threatened by deforestation due to conversion to agriculture of lands better suited to other purposes, over-grazing, over-harvesting, and other causes which pose a direct adverse threat to people, the global environment, and the world economy.";

(2) in section 2(b), after the words "non-Federal forest lands,", add the words "in the United States, and forest lands in foreign countries,"; and

(3) in section 10, add the following new subsection at the end thereof:

"(h) In addition to the authority provided elsewhere in this Act, the Secretary is authorized to assist other countries with respect to the activities identified in section 3(b), paragraphs (1) through (6), section 5(b), paragraphs (1) through (5), and section 7(b), paragraphs (1) through (3). For the purposes of assistance to other countries under this subsection, the term 'non-Federal forest land' shall mean any forest land and related renewable natural resources in such countries. In providing the assistance authorized by this subsection, the Secretary shall coordinate with other Federal officials, departments, agencies, or international organizations, as the President may direct. The references to 'State foresters or equivalent State officials' in this Act shall not apply to the assistance provided by the Secretary to other countries under this subsection.".

Subtitle B—Forestry Planning and Global Warming

SEC. 215. AMENDMENTS TO THE FOREST AND RANGELAND RENEWABLE RESOURCES PLANNING ACT OF 1974.

(a) AMENDMENTS.—Section 3(a) of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1601(a)) is amended—

(1) by deleting "and" after the semicolon in paragraph (3);

(2) by deleting the period at the end of paragraph (4) and inserting in lieu thereof a semicolon and the word "and"; and

(3) by adding at the end thereof the following new paragraphs:

"(5) a detailed analysis of the potential effects of climate change on the condition of renewable resources on America's forests and rangelands; and

"(6) a detailed analysis of the rural and urban forestry opportunities to mitigate the buildup of atmospheric carbon dioxide and reduce the risk of climate change from global warming,".

(b) AMENDMENTS.—Section 4 of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1602) is amended—

(1) by deleting "and" immediately after the semicolon in paragraph (5)(D);

(2) by deleting the period at the end of paragraph (5)(E) and inserting in lieu thereof a semicolon and the word "and"; and

(3) by adding at the end thereof the following new subparagraph:

"(F) account fully for the effects of climate change on forest and rangeland conditions, including potential effects on the geographic ranges of species, and on forest and rangeland products.".

(c) AMENDMENT.—Section 6(e)(2) of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1604(e)(2)), as amended by the National Forest Management Act of 1976, is amended by inserting immediately before the period at the end thereof a comma and following: "and the potential effects of climate change on the condition of forest lands, natural resources and ecosystems".

Subtitle C—Urban Forestry

SEC. 221. URBAN FORESTRY ENERGY CONSERVATION PROGRAM.

The Congress finds that—

(1) the Earth's atmosphere is being changed at a rapid rate resulting from human activities, especially as

related to the burning of fossil fuels, and the concurrent destruction of trees and forests;

(2) the results of these activities contribute to an increase in the so-called greenhouse gases, especially carbon dioxide;

(3) the improved management and expansion of forests are essential to reduce the rate of buildup of the so-called greenhouse effect;

(4) the risks of global warming are sufficiently great that positive action is warranted to alleviate the potential consequences;

(5) cities increasingly experience so-called heat island effects as a result of human activities that produce heat, and the absorption and retention of heat by buildings, pavement, and other portions of the built-environment;

(6) trees, when properly sited around urban buildings, have been shown by research at Federal laboratories to be effective at ameliorating the so-called heat island effects, offering a low-cost way to reduce air-conditioning needs which will in turn reduce carbon dioxide emissions from electrical generation;

(7) an urban tree is 15 times more effective than a forest tree at reducing the buildup of carbon dioxide emissions, through the "oasis effect" of cooling urban

heat islands; and to directly sequester the amount of carbon saved by the planting of 100 million urban trees, it would require the planting of 1.5 billion forest trees;

(8) reducing each pound of atmospheric carbon dioxide through tree planting costs about 0.3 to 1.3 cents, while through improved appliances it costs about 2.5 cents per pound, and through more efficient cars it costs 10 cents per pound;

(9) studies have shown that urban trees are disappearing and that approximately four trees are dying for each tree planted in most cities;

(10) enormous opportunities exist to plant energy efficient trees in urban areas, such as 100 million spaces near residences and small commercial buildings, and another 60 million spaces along streets, as well as parks and other open areas;

(11) to achieve the maximum benefits from trees, public education, technical assistance, research, and incentives to plant more trees will be required;

(12) the American Forestry Association has initiated Global ReLeaf, a public information and education campaign to encourage tree planting, and better forest management nationally and internationally, with the initial goal of planting 100 million trees in cities by

1992 to capture the benefits of trees for energy conservation.

SEC. 222. URBAN FORESTRY ENERGY CONSERVATION PROGRAM.

(a) PLANTING PROGRAM.—The Secretary of Agriculture, in conjunction with other relevant governmental agencies, and interested members of the public, shall carry out an urban forestry education and accelerated planting program for reducing carbon dioxide emissions and conserving energy and improving urban air quality, in addition to providing other environmental benefits. The program shall include citizen education, technical assistance, and accelerated demonstration plantings to show the contributions of trees in meeting environmental needs in urban areas.

(b) SERVICES.—For the purpose of urban forestry energy conservation, this Act authorizes—

(1) education to encourage owners of private residences and commercial properties to plant and maintain energy-saving trees;

(2) technical assistance to local units of government in selecting, locating, planting, and maintaining urban trees;

(3) a tree planting program supported through competitive matching grants to local units of govern-

ment, or IRS-approved 501–C3 organizations pending approval of a plan; and

(4) applied research to provide data on costs and savings associated with tree planting for energy conservation purposes, to suggest a range of public policies and incentives to further encourage public and private efforts to plant trees, and maintain them in the hostile urban environment.

(c) Report.—The Secretary of Agriculture shall report to Congress annually on the effectiveness of this program as part of the Annual Report of the Forest Service prepared pursuant to section 8(c) of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended (16 U.S.C. 1606).

(d) Authorizations.—For fiscal year 1990, and each fiscal year thereafter, there are authorized to be appropriated such sums as may be necessary to carry out the provisions of this section.

(e) Assistance.—In carrying out this section, the Secretary shall work with, and utilize the assistance of, the United States Department of Agriculture Cooperative Extension Service, the United States Department of Agriculture Forest Service, forestry and research services of States, universities, and private entities, the Environmental Pretection

Agency, the Department of Energy, the Department of the Interior, and the Agency for International Development.

Subtitle D—Biomass Energy Demonstration Projects

SEC. 231. PROJECTS.

The Secretary of Agriculture is authorized to carry out projects that demonstrate the potential of short-rotation silvicultural methods to produce wood for electricity production and industrial energy needs. In carrying out such projects, the Secretary shall cooperate with private industries, Federal and State agencies, and other organizations.

Subtitle E—Forestry Research and Global Warming

SEC. 241. AMENDMENTS TO THE FOREST AND RANGELAND RENEWABLE RESOURCES RESEARCH ACT OF 1978.

(a) AMENDMENTS.—Section 3(a) of the Forest and Rangeland Renewable Resources Research Act of 1978, as amended (16 U.S.C. 1642(a)) is amended—

(1) by deleting "five" and inserting in lieu thereof "six" and by deleting "(5)" and inserting in lieu thereof "(6)" in the first paragraph;

(2) by inserting "biodiversity, germ plasm reserves," immediately after "fish and wildlife," in paragraph (1); and

(3) by inserting at the end thereof a new paragraph as follows:

"(6) Renewable resource response to environmental stress research shall include, as appropriate, research activities related to understanding the effects of weather, climate, and air pollution on forests and rangelands, understanding the effects of forest and rangeland management activities on weather, climate, and air pollution, and developing the scientific and technical basis of alternatives for adaptation to environmental stress and mitigation of adverse impacts that affect the management and protection of forests and rangelands.".

(b) AMENDMENT.—Section 3(c)(4)(B)(ii) of the Forest and Rangeland Renewable Resources Research Act of 1978, as amended (16 U.S.C. 1642(c)(4)(B)(ii)) is amended by inserting "and other anthropogenic environmental stress" immediately after "effects of atmospheric pollution".

Subtitle F—Conservation Reserve Program

SEC. 251. TREE PLANTING ON CONSERVATION RESERVE PROGRAM LANDS.

The Secretary shall take such measures as are necessary to achieve the Conservation Reserve tree planting goal of at least 12.5 percent of the total 40–45 million acres target specified in section 1232(c) of the Food Security Act of 1985, including, but not limited to: modification of existing contracts to cost-share tree planting; continuous sign-up for tree planting; 10- or 15-year contracts, at the option of the producer, for hardwood tree planting; and 75 percent cost-sharing for hardwood tree planting.

Subtitle G—Interagency Cooperation on Forestry and Climate Change

SEC. 261. INTERAGENCY COOPERATION TO MAXIMIZE BIOMASS GROWTH.

The Secretary of Agriculture is authorized to enter into agreement with the Secretary of Defense to—

(1) conduct a study of reforestation and improved management of Defense Department military installations and lands; and

(2) develop a program to manage these forests and lands so as to maximize their potential for biomass growth and sequestering carbon dioxide.

SEC. 262. AUTHORIZATION.

There are authorized to be appropriated for fiscal year 1990, and each of the next following 2 fiscal years, $2,000,000 to carry out the program in this subtitle.

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